

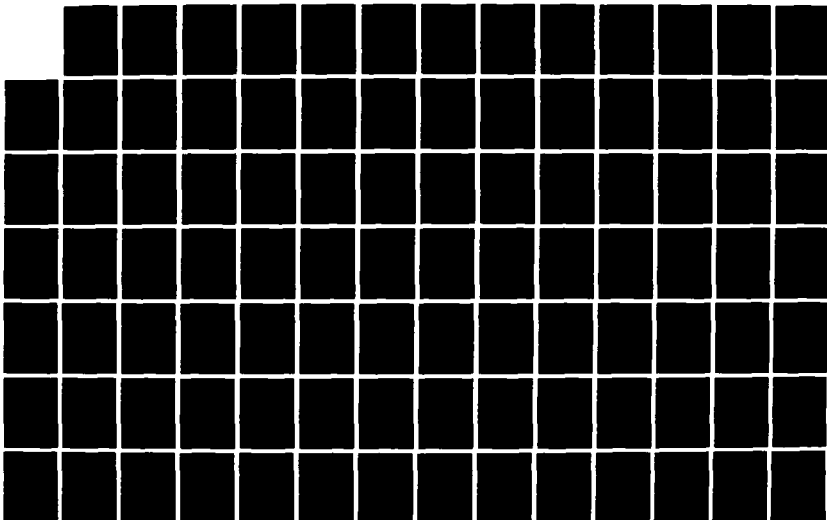
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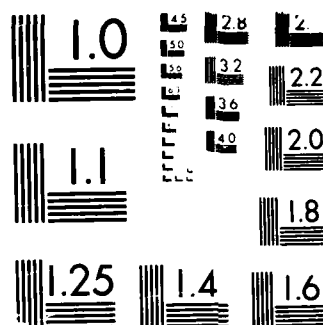
VERTICAL DIRECTIONALITY OF AMBIENT NOISE AT 32 DEG N AS 1/2
A FUNCTION OF LONG. (U) SCRIPPS INSTITUTION OF
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W S HODGKISS ET AL. JAN 88 MPL-TM-387-E

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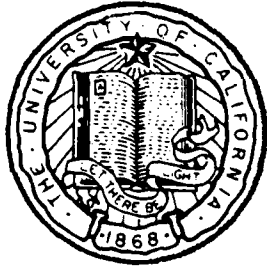
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San Diego, California 92152

MARINE PHYSICAL LABORATORY

SCRIPPS INSTITUTION OF OCEANOGRAPHY

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VERTICAL DIRECTIONALITY OF AMBIENT NOISE
AT 32° N AS A FUNCTION OF LONGITUDE:
Tape #86180

W. S. Hodgkiss and F. H. Fisher

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MPL TECHNICAL MEMORANDUM 387-E

MPL-U-32/86

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January 1988

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<p>Measurements have been made of the ambient noise field between 25 and 300 Hz with vertical arrays at 32°N (124°W, 136°W, and 150°W). This technical report contains the complete analysis results for the MPL 27-element vertical array Tape #86180. The tape was recorded at 32°N, 150°W (approximately 1700 nmi due west of San Diego) on 5 May 1986 beginning at 10:09 PDT. At that time, the wind speed was 10 kts.</p>				
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Vertical Directionality of Ambient Noise

at 32° N as a Function of Longitude:

Tape #86180

W.S. Hodgkiss and F.H. Fisher

Marine Physical Laboratory
Scripps Institution of Oceanography
San Diego, CA 92152

Abstract

Measurements have been made of the ambient noise field between 25 and 300 Hz with vertical arrays at 32° N (124° W, 136° W, and 150° W). This technical report contains the complete analysis results for the MPL 27-element vertical array Tape #86180. The tape was recorded at 32° N, 150° W (approximately 1700 nmi due west of San Diego) on 5 May 1986 beginning at 10:09 PDT. At that time, the wind speed was 10 kts.

I. Introduction

This technical report contains the complete analysis results for the MPL 27-element vertical array Tape #86180. The tape was recorded at 32° N, 150° W (approximately 1700 nmi due west of San Diego) on 5 May 1986 beginning at 10:09 PDT. At that time, the wind speed was 10 kts.

A complete description of the experiment and data analysis procedure is given in the summary technical report (TM-387-A). Here, a brief guide will be provided to the results documented in the various sections.

Section II (Preliminary Analysis) provides a preliminary look at the data quality from 4 hydrophones spaced approximately equally across the array for the first data segment (65536 points). The results are ordered as follows:

- (1) Channel means (A/D counts).
- (2) Time series (A/D counts) for the first 1024 points of the first segment.
- (3) Time-varying mean (A/D counts, 64-point averages).
- (4) Time-varying power (A/D counts squared, 64-point averages) (channel means have been removed).
- (5) Power spectra (dB// μ Pa/ $\sqrt{\text{Hz}}$) (channel means have been removed).

Section III (Power Spectra) provides an extended preliminary look at the power spectra from all hydrophones in the array for the first data segment (65536 points). The results are ordered as follows:

- (1) Channel means (A/D counts).
- (2) Power spectra (dB// μ Pa/ $\sqrt{\text{Hz}}$) (channel means have been removed).

Section IV (Array Response: Waterfall, KB Window) provides waterfall plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape (dB// μ Pa/ $\sqrt{\text{HzDeg}}$). A Kaiser-Bessel window ($\alpha = 1.5$) was used to amplitude shade the array elements.

Section V (Array Response: Waterfall, Rect Window) provides waterfall plots of the time-evolving

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vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape ($\text{dB}/\mu\text{Pa}/\sqrt{\text{HzDeg}}$). A rectangular window was used to amplitude shade the array elements.

Section VI (Array Response: Panels, KB Window) provides multi-panel plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape ($\text{dB}/\mu\text{Pa}/\sqrt{\text{HzDeg}}$). A Kaiser-Bessel window ($\alpha = 1.5$) was used to amplitude shade the array elements.

Section VII (Array Response: Panels, Rect Window) provides multi-panel plots of the time-evolving vertical directionality of ambient noise for successive segments (65536 points) across the entire data tape ($\text{dB}/\mu\text{Pa}/\sqrt{\text{HzDeg}}$). A rectangular window was used to amplitude shade the array elements.

II. Preliminary Analysis.

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Channel #10

1 14.558151245117

Channel #20

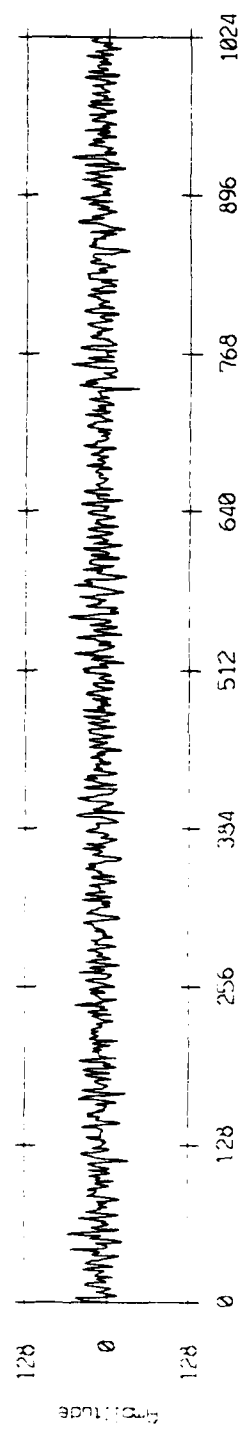
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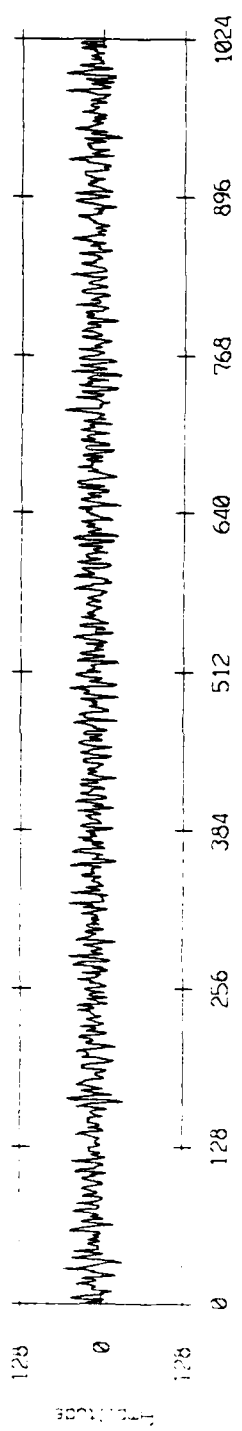
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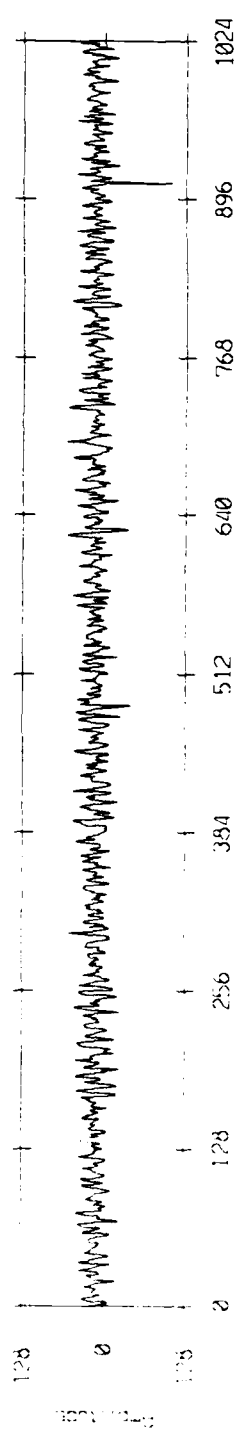
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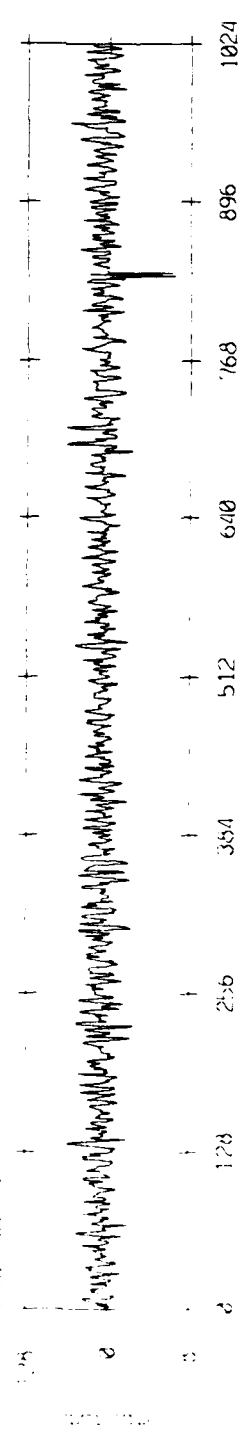
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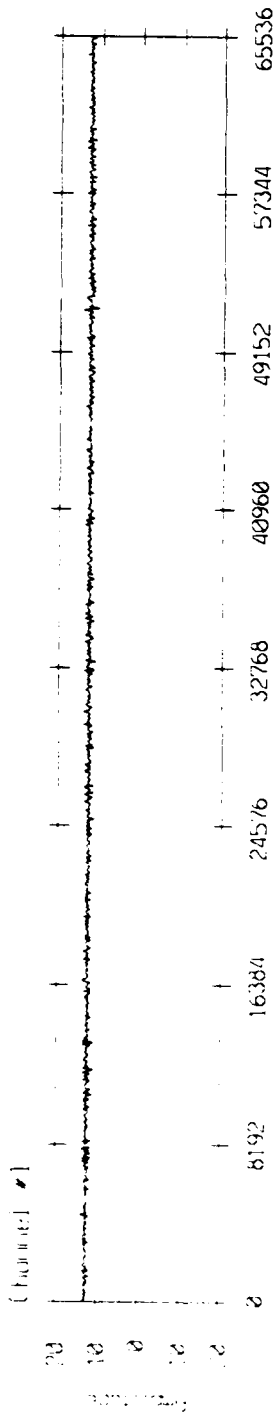
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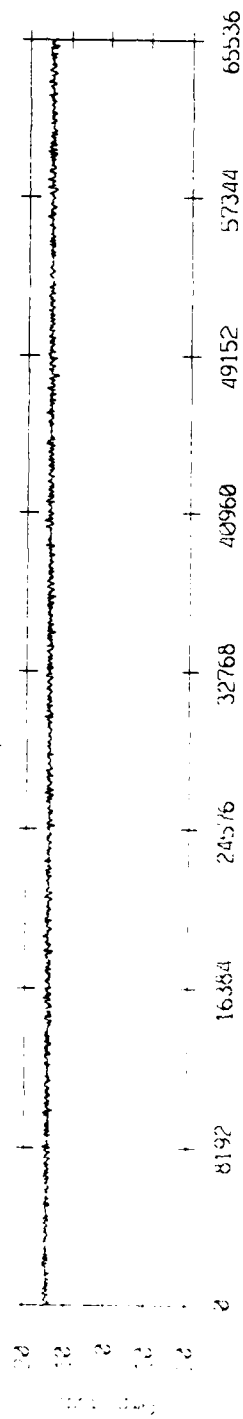
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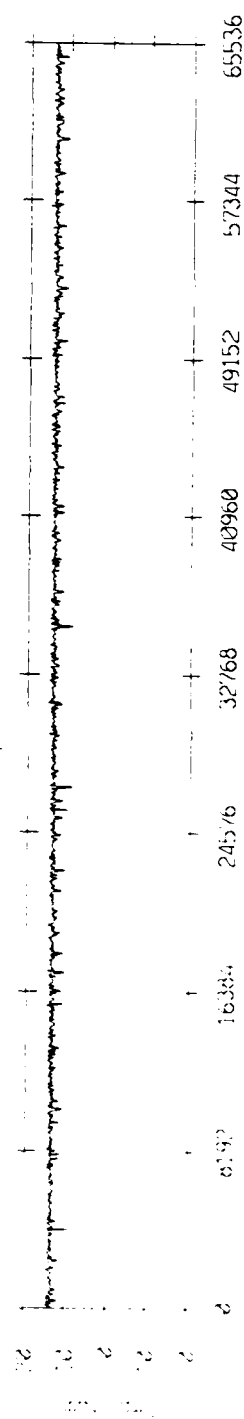
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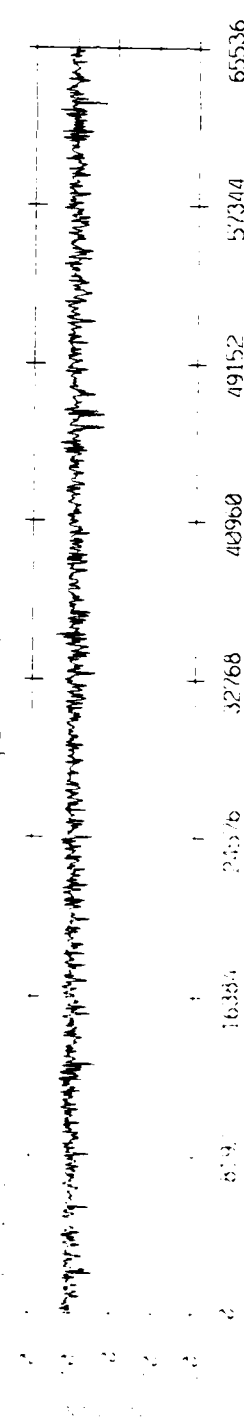
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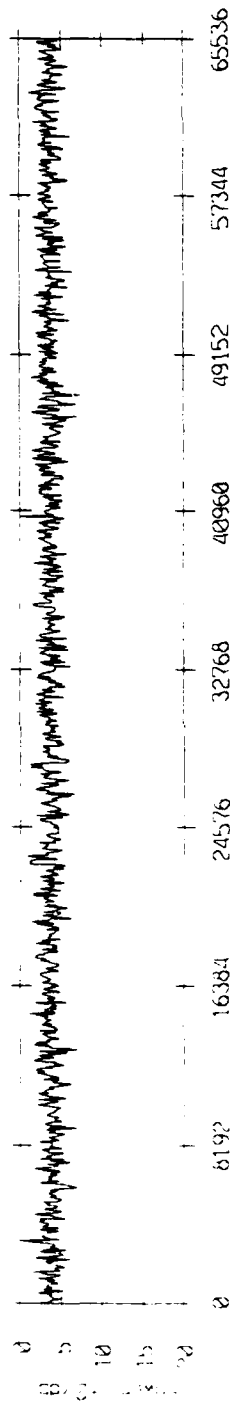


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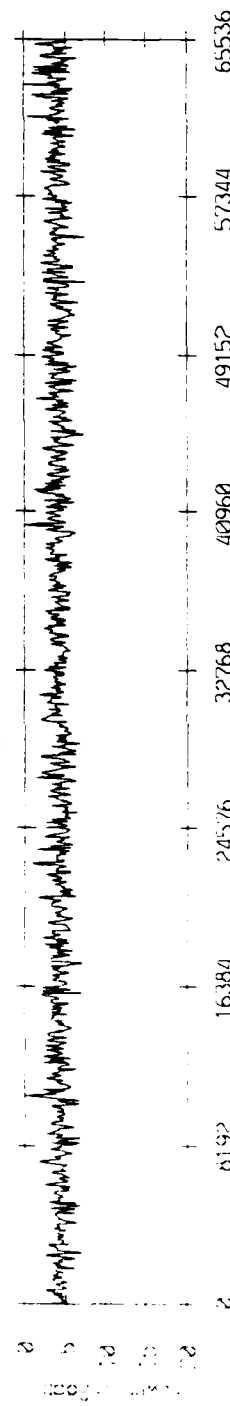


Time Series Power 86180.1

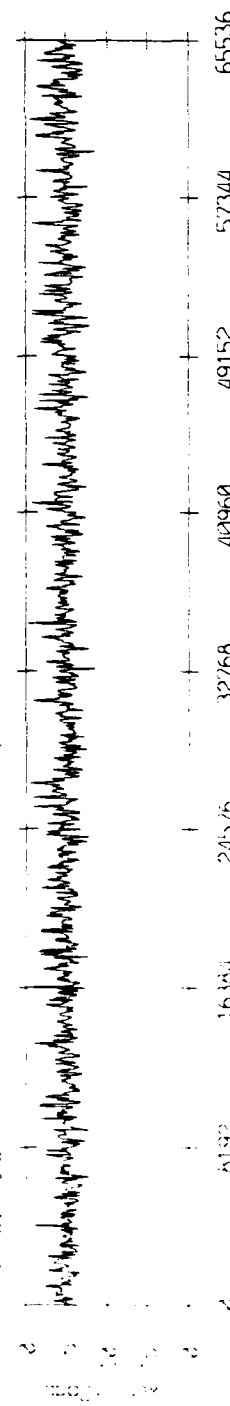
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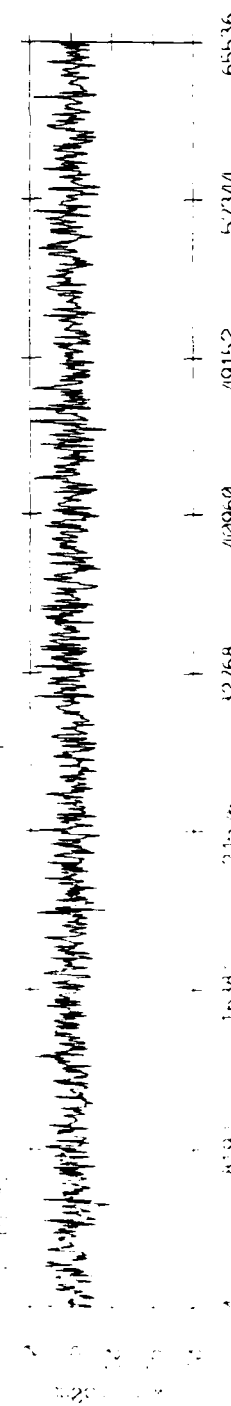
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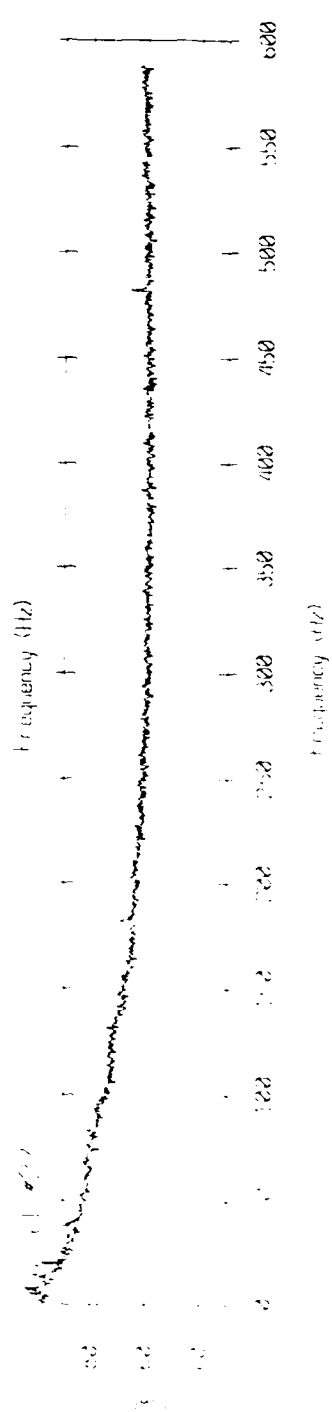
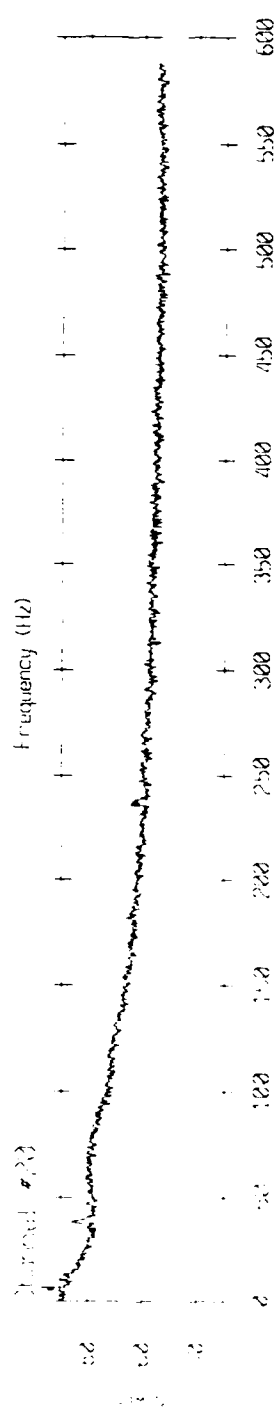
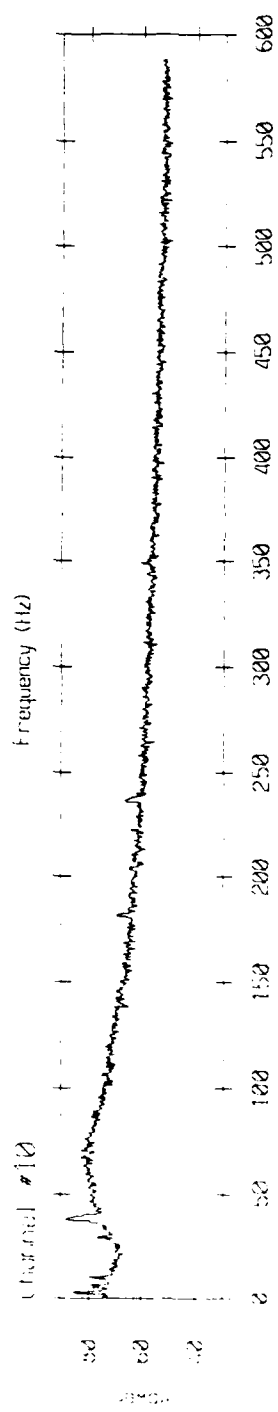
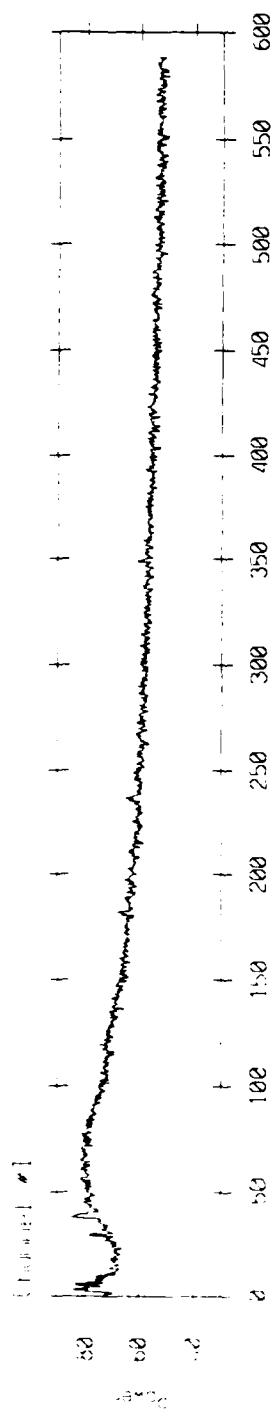


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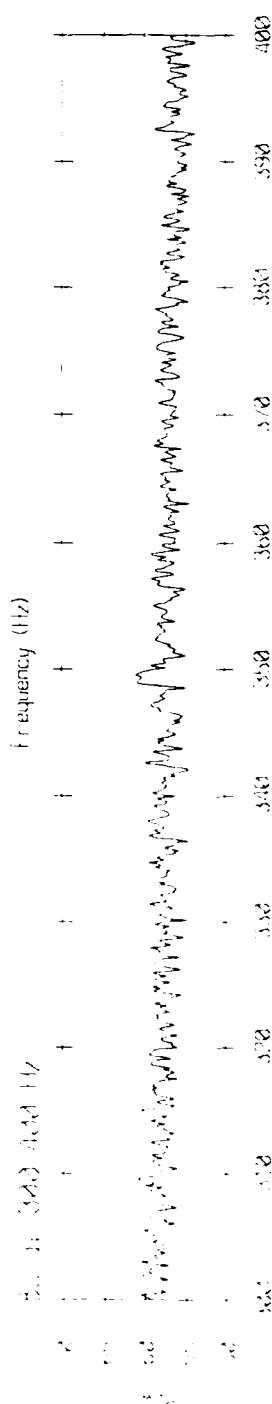
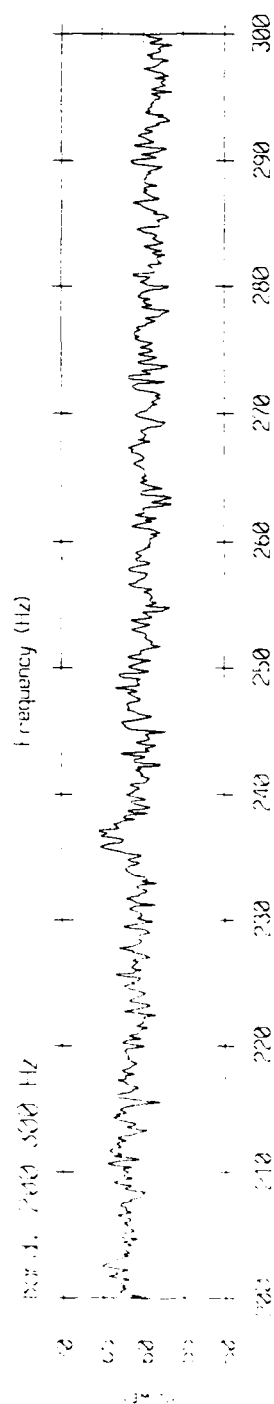
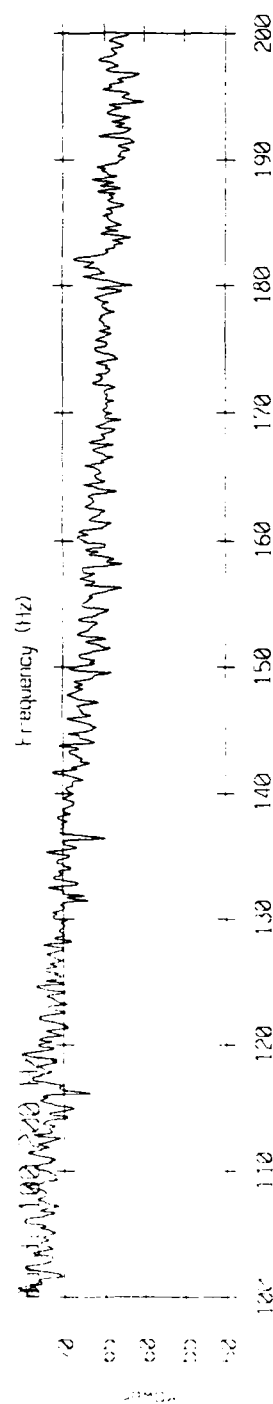
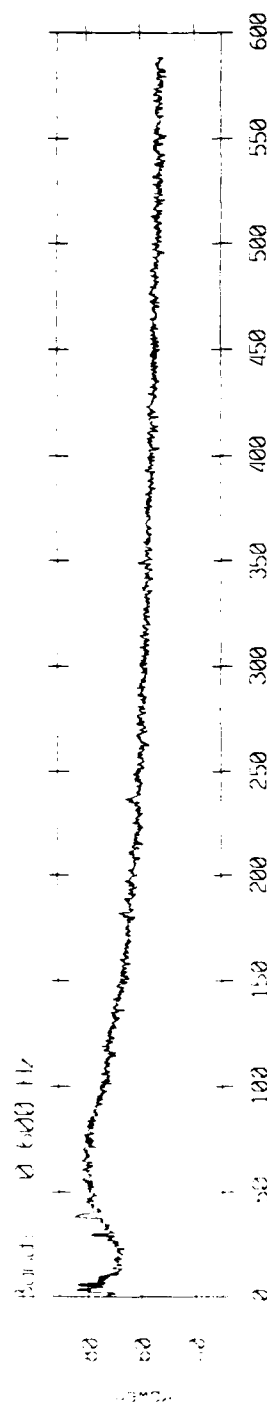


Sequence Number (n)

Power Spectrum 86180.1



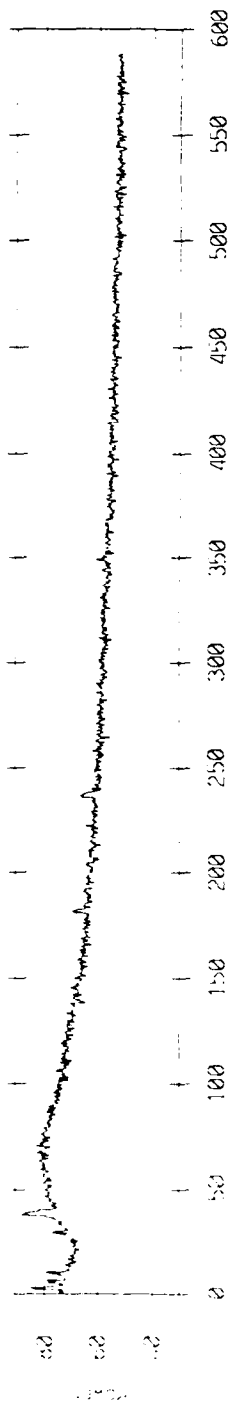
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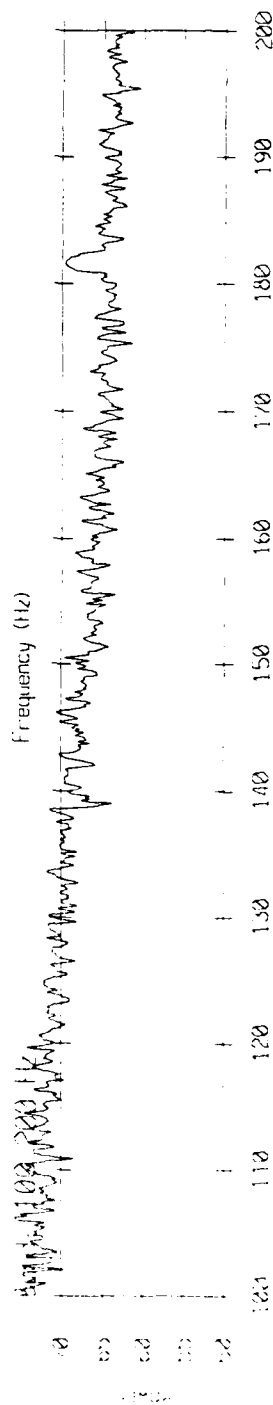
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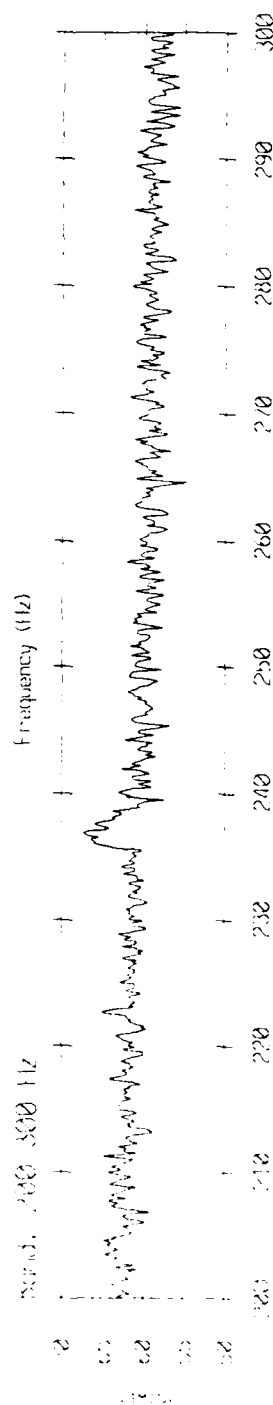
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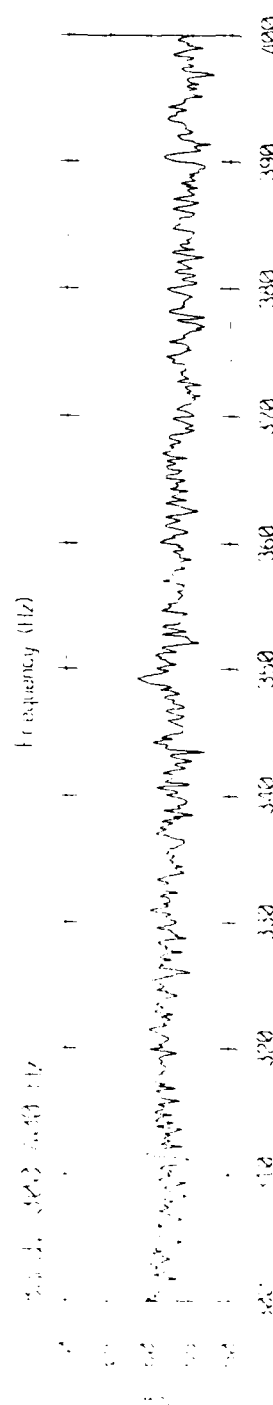
Frequency (Hz)



Frequency (Hz)



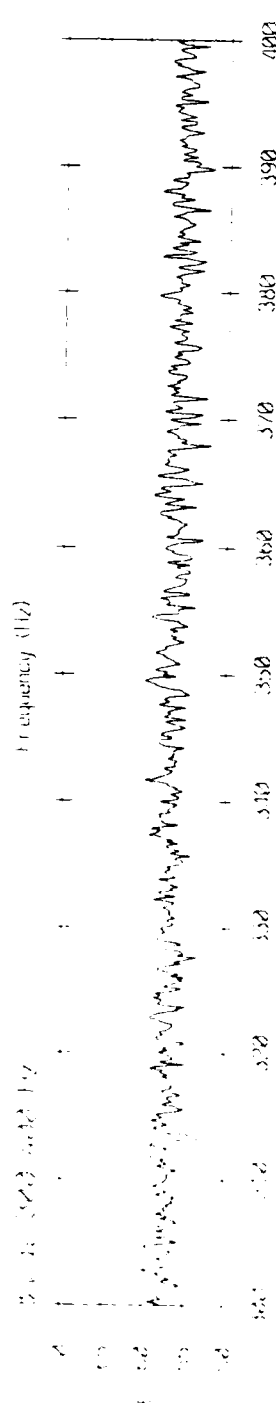
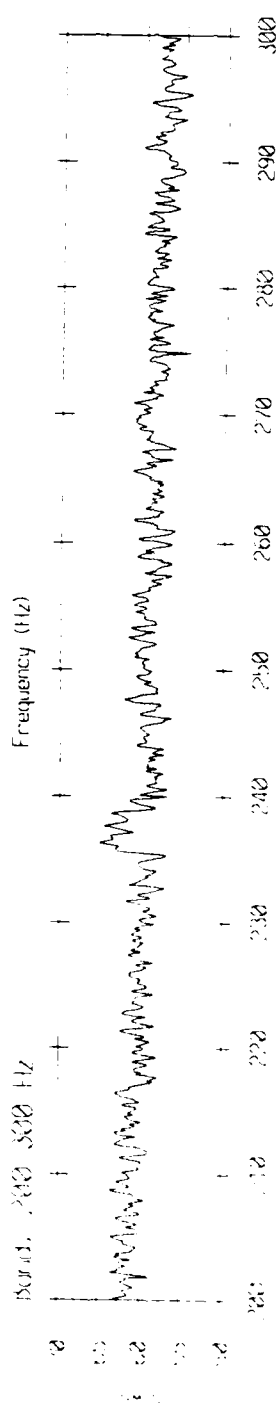
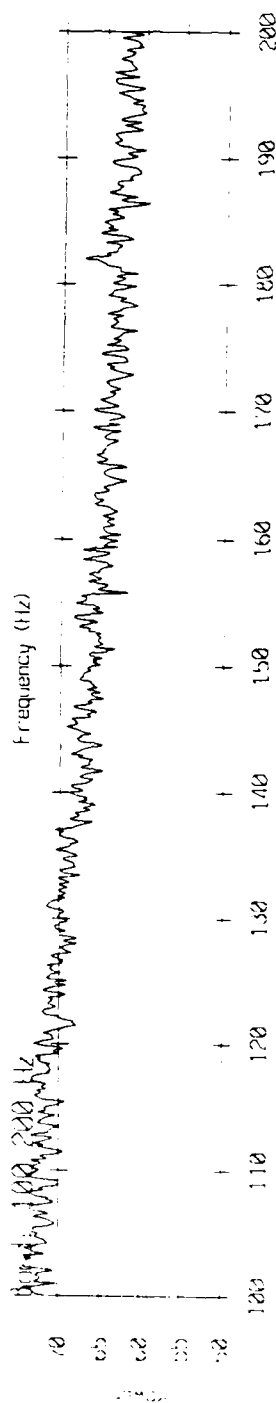
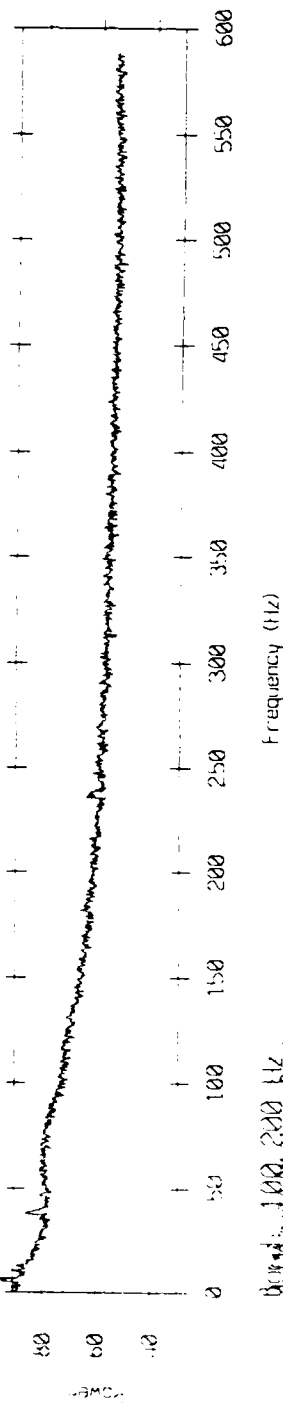
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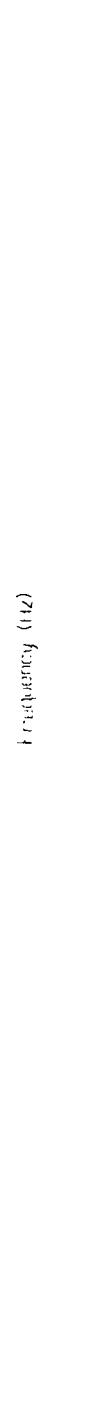
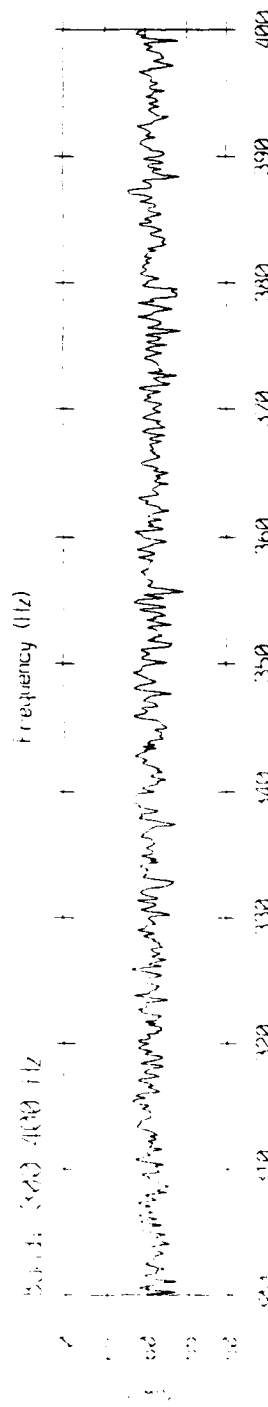
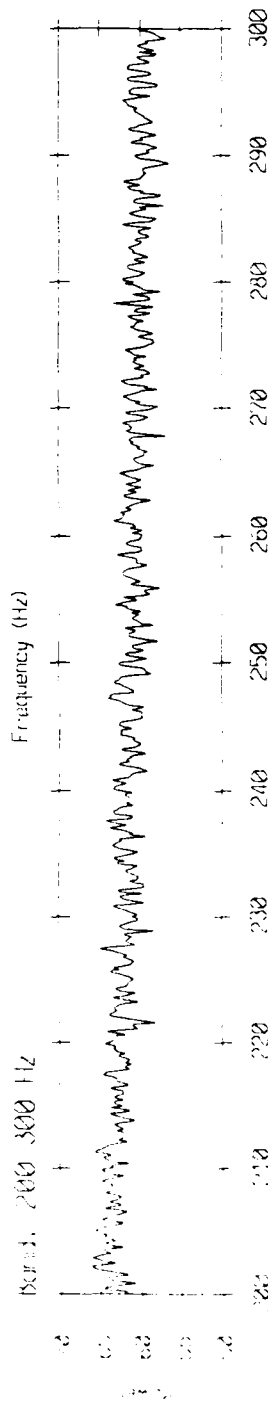
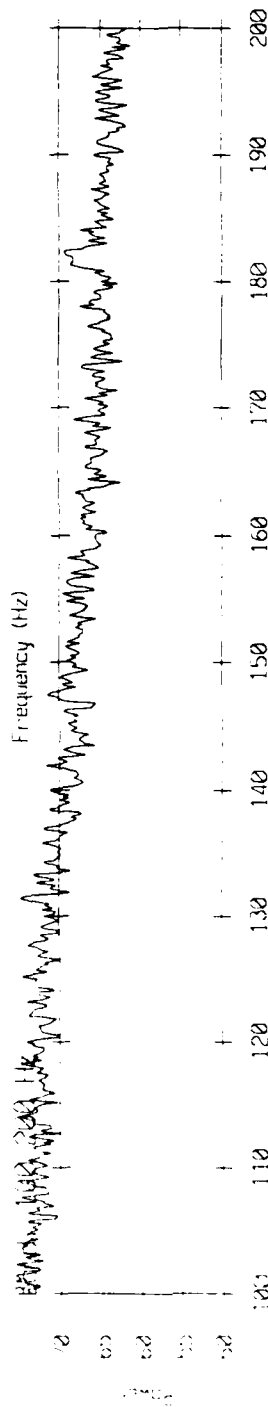
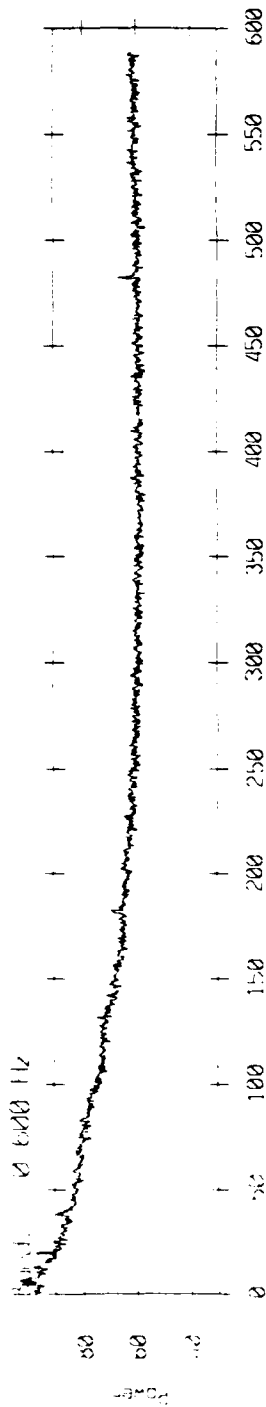
Frequency (Hz)

Power Spectrum 86180.1 Channel #20

Band: 0 600 Hz



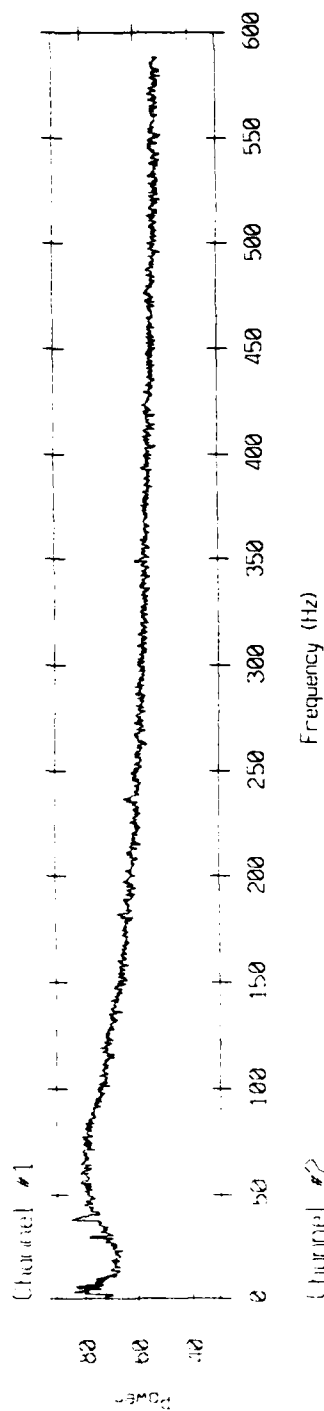
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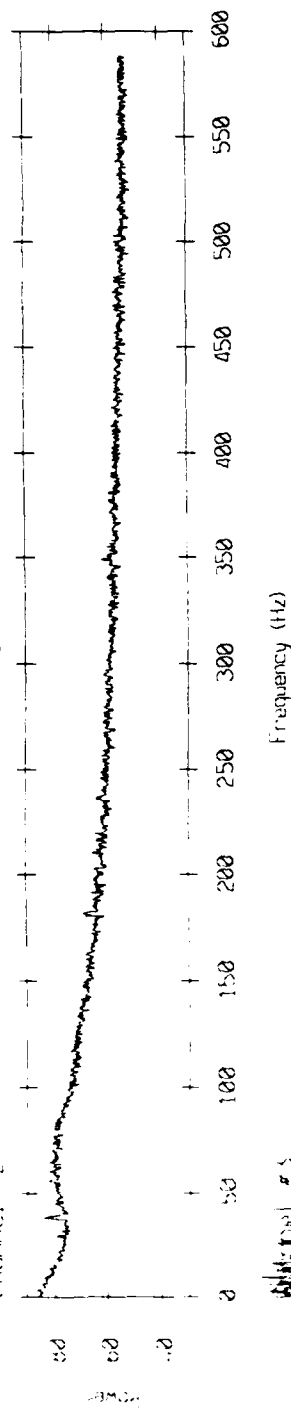
III. Power Spectra.

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Channel #2
1 11.481094360352
Channel #3
1 11.441101074219
Channel #4
1 10.964447021484
Channel #5
1 12.799743652344
Channel #6
1 9.9189805712891
Channel #7
1 14.751235961914
Channel #8
1 14.947845456984
Channel #9
1 6.4825439453125
Channel #10
1 14.558151245117
Channel #11
1 10.523478535156
Channel #12
1 14.188262939453
Channel #13
1 11.582733154297
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1 13.047485351563
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1 12.429428100586
Channel #16
1 8.7006225585938
Channel #17
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Channel #18
1 12.799850463867
Channel #19
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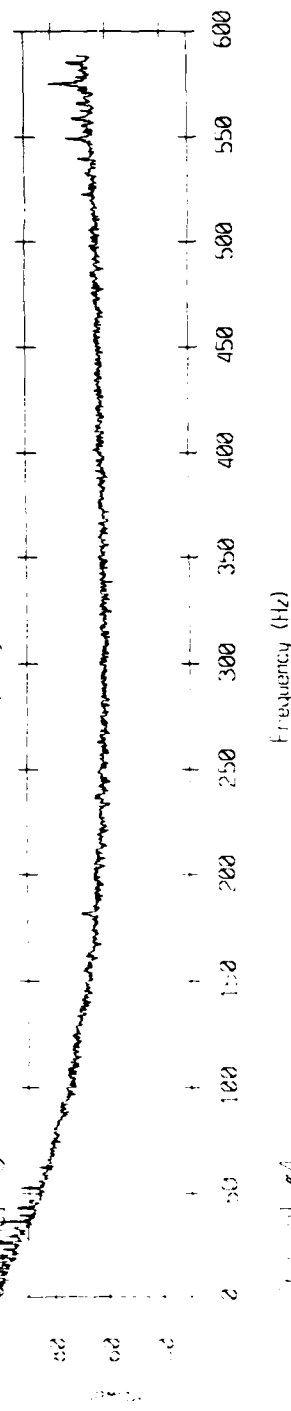
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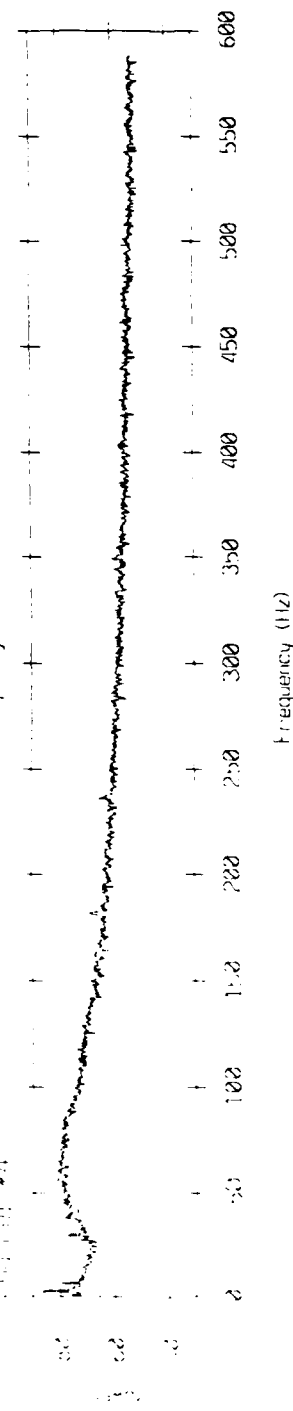
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Channel #3

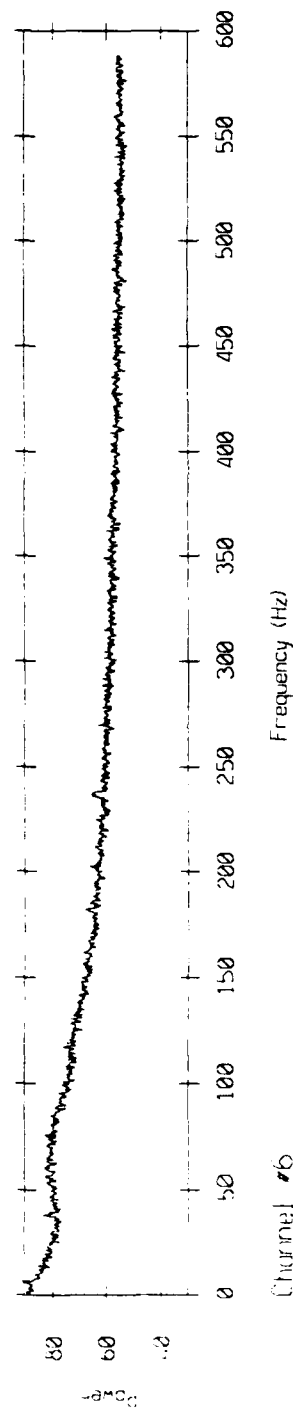


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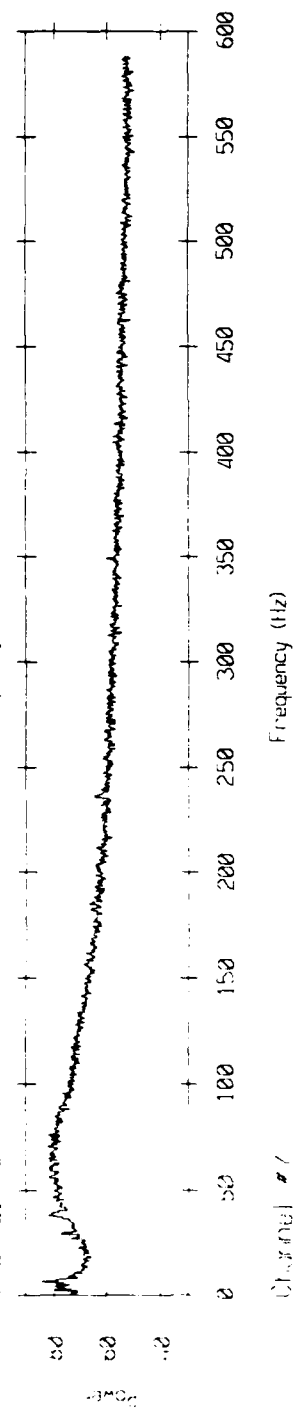


Power Spectrum - 86180.1

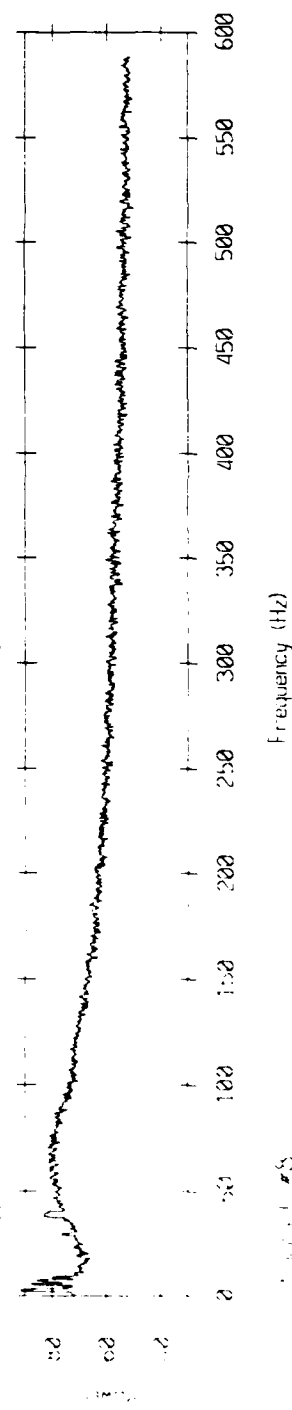
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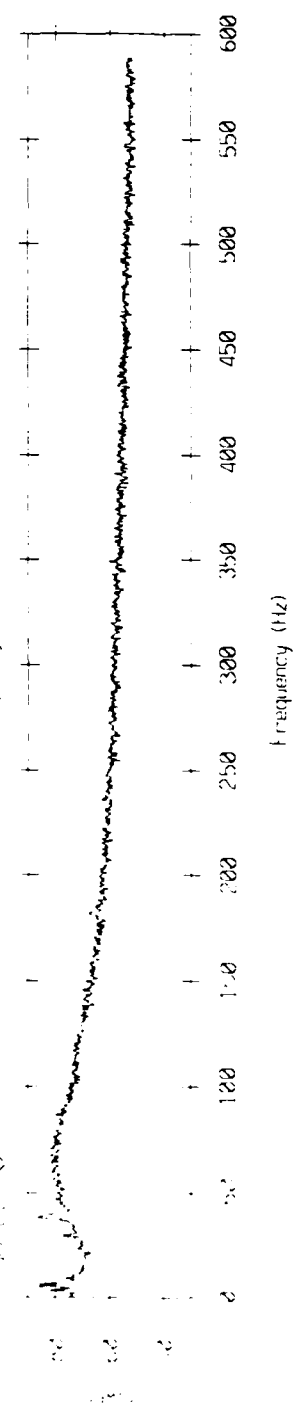
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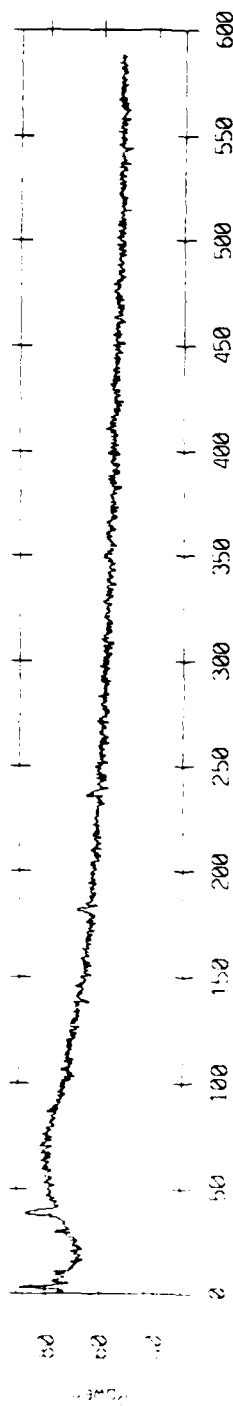


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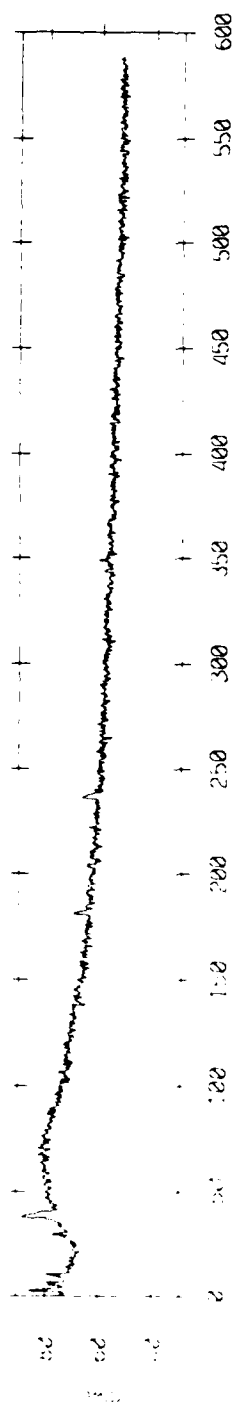
Power Spectrum - 86180.1

Channel #9



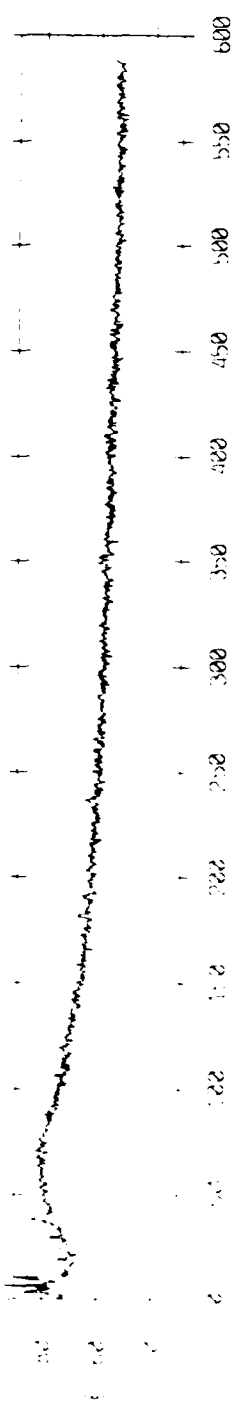
Channel #10

Frequency (Hz)



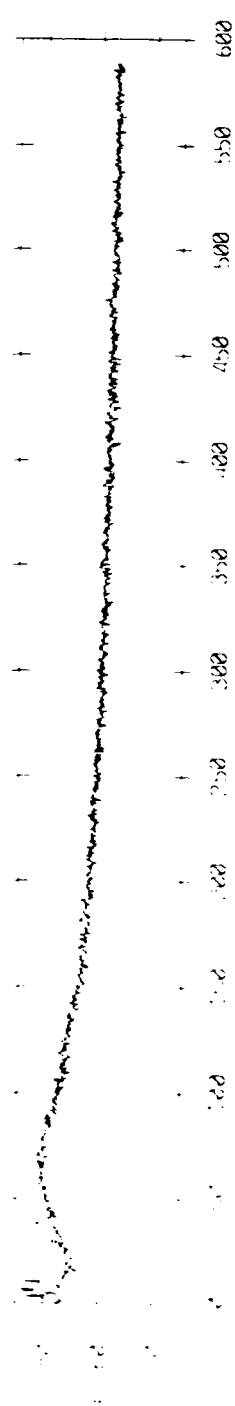
Channel #11

Frequency (Hz)



Channel #12

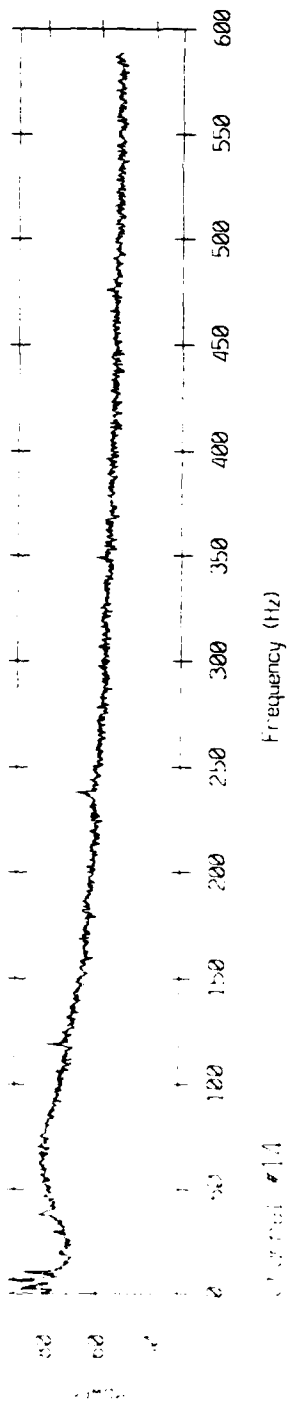
Frequency (Hz)



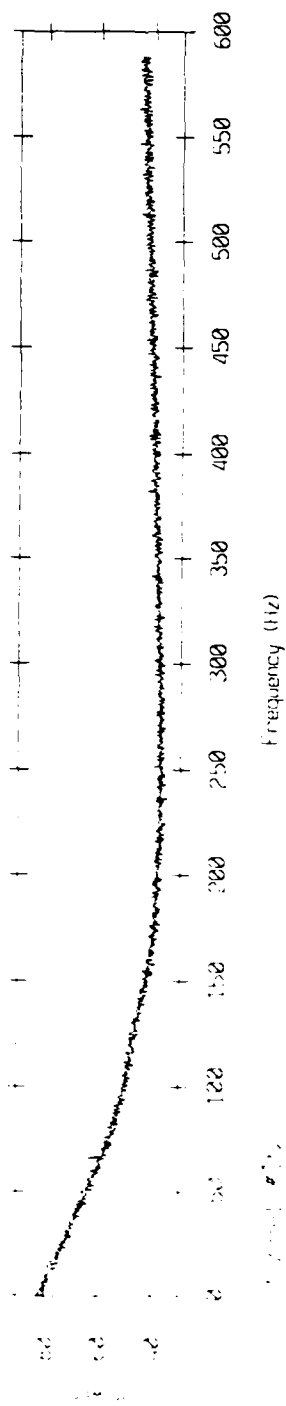
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Power Spectrum 86180.1

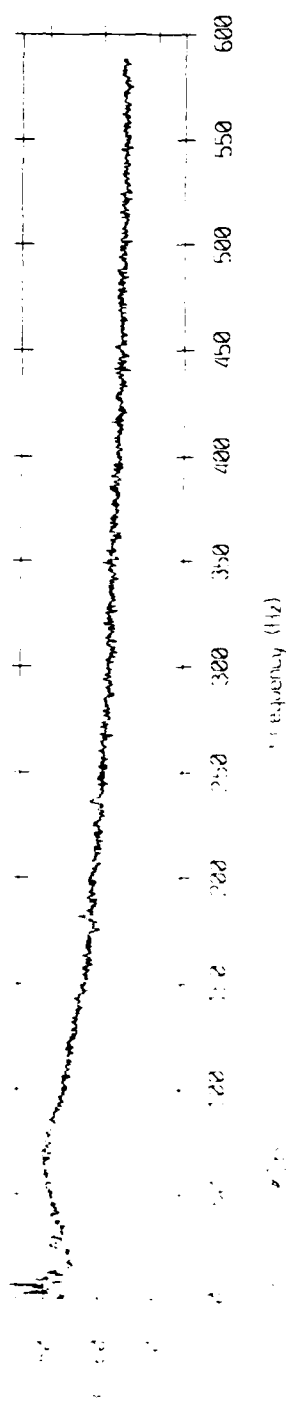
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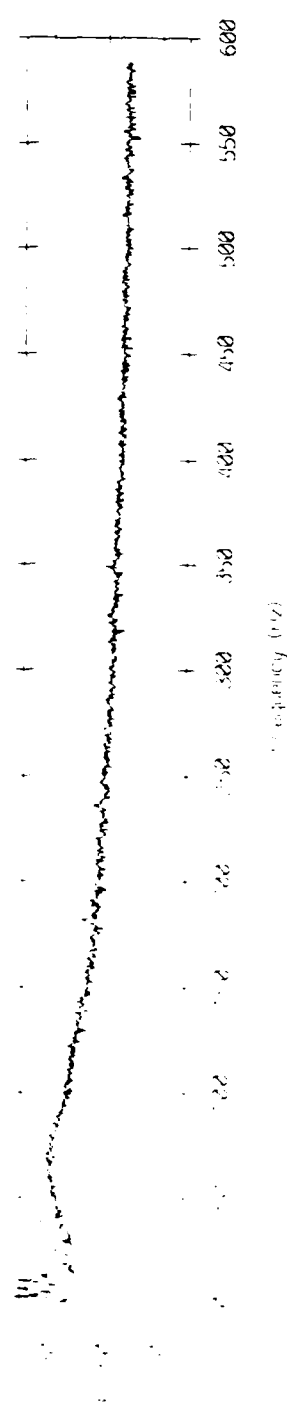
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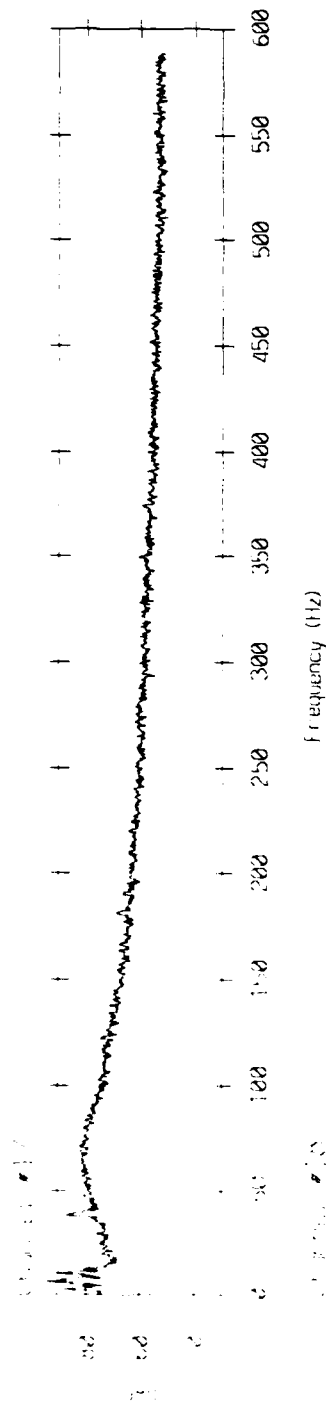
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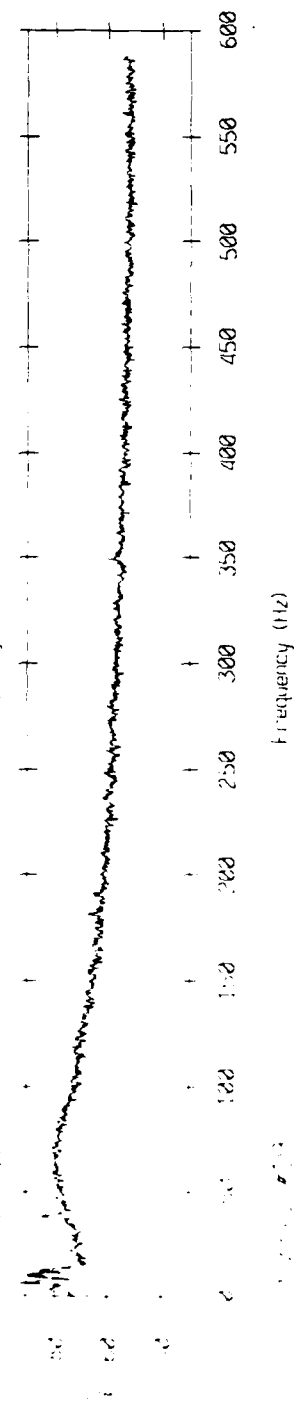
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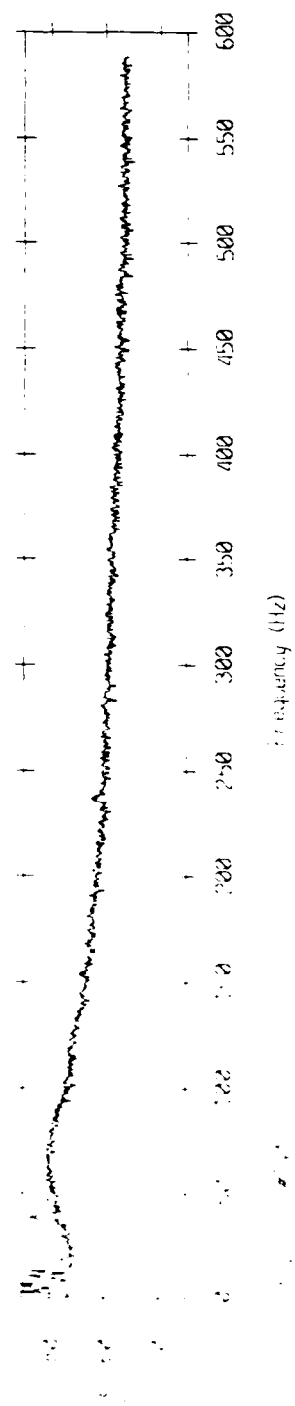
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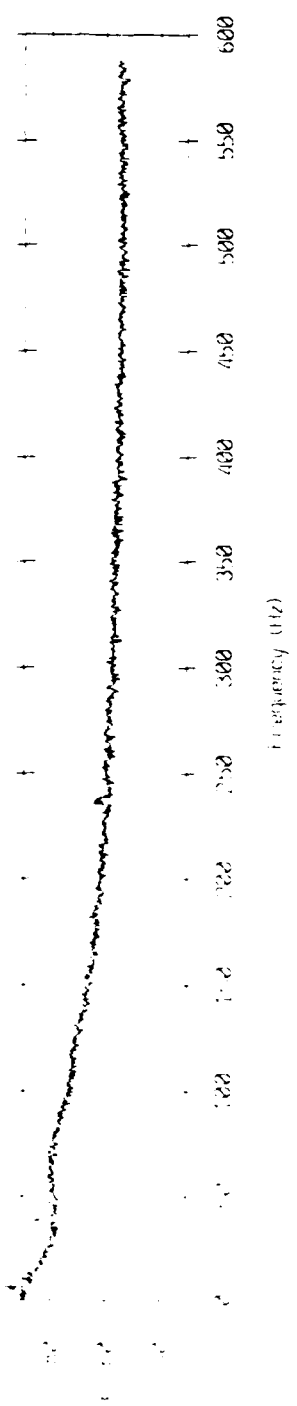
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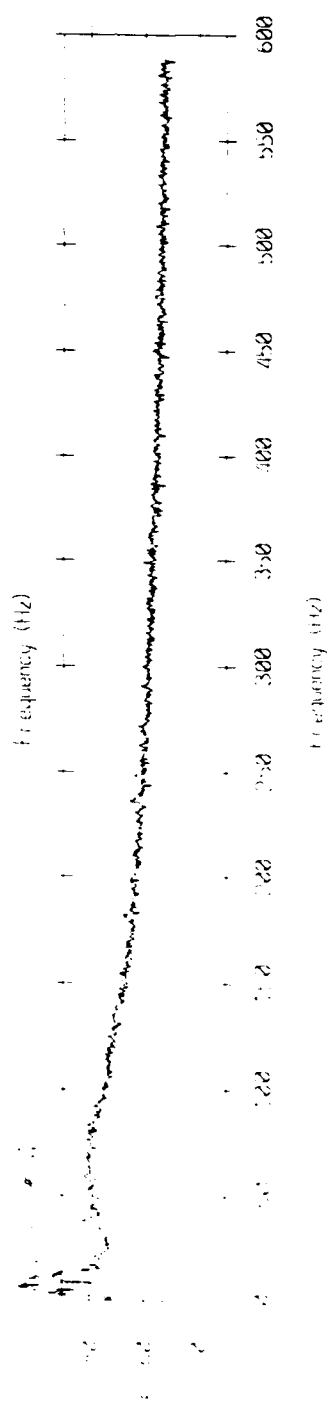
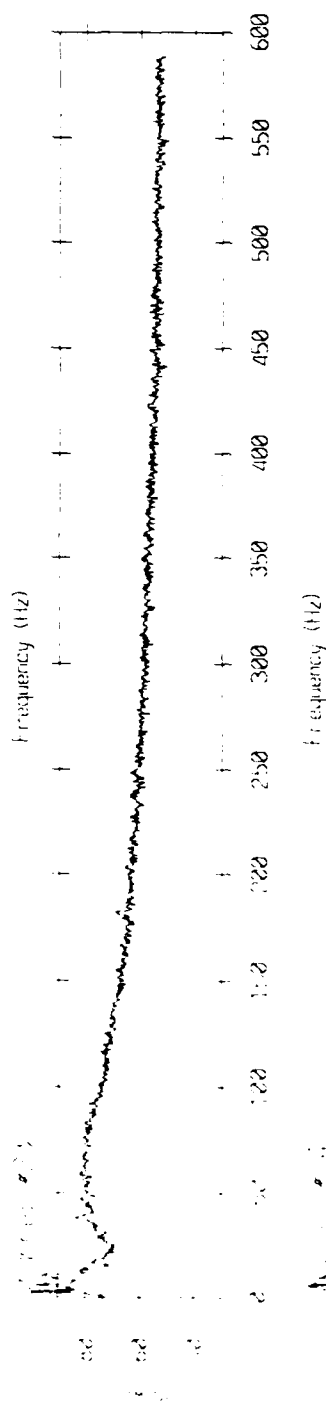
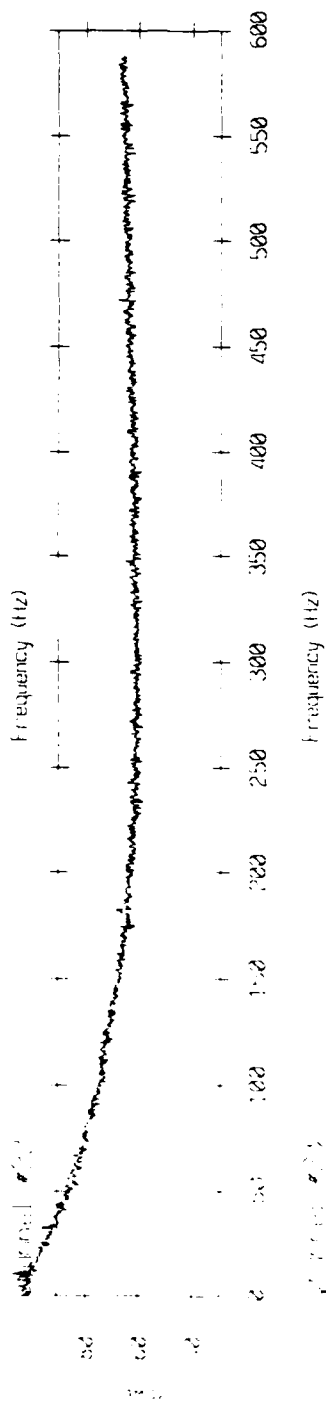
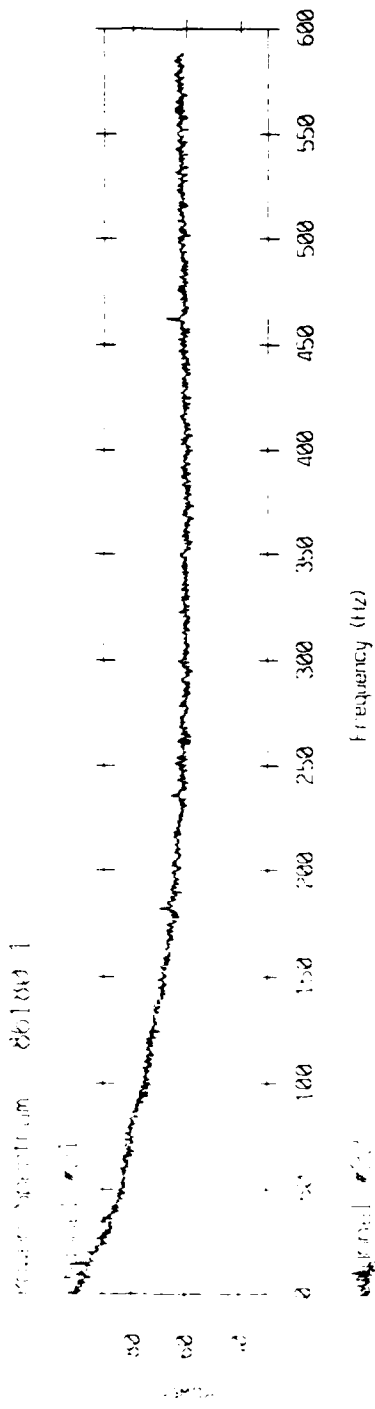


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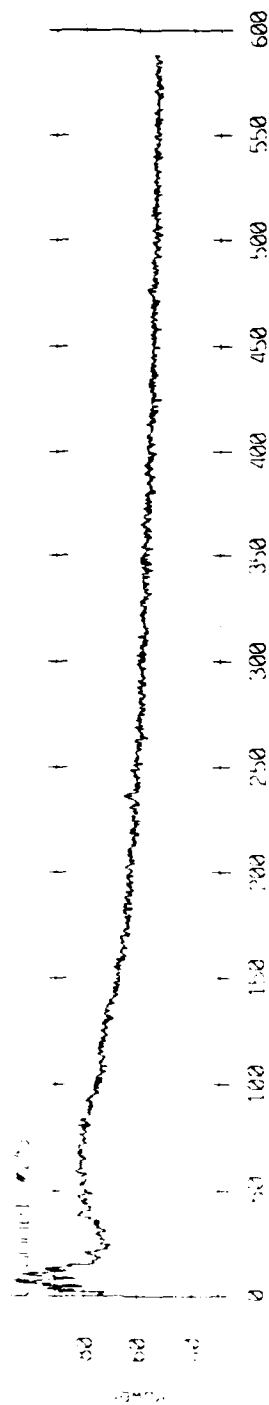


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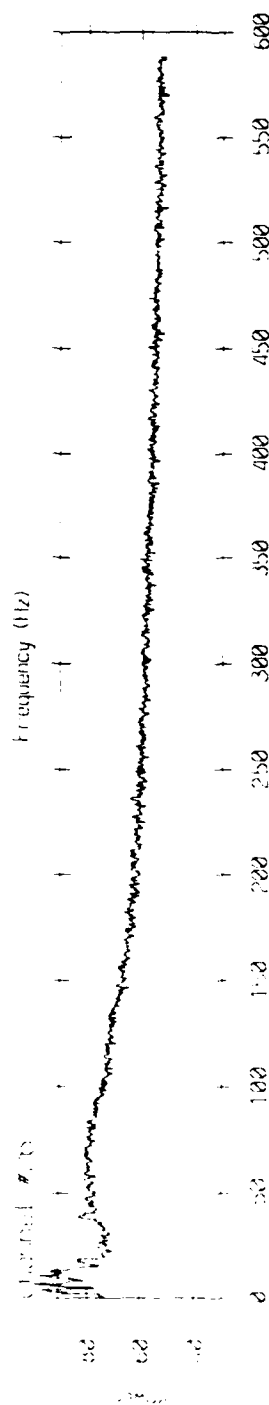




Power Spectrum 861841



Power Spectrum 861841

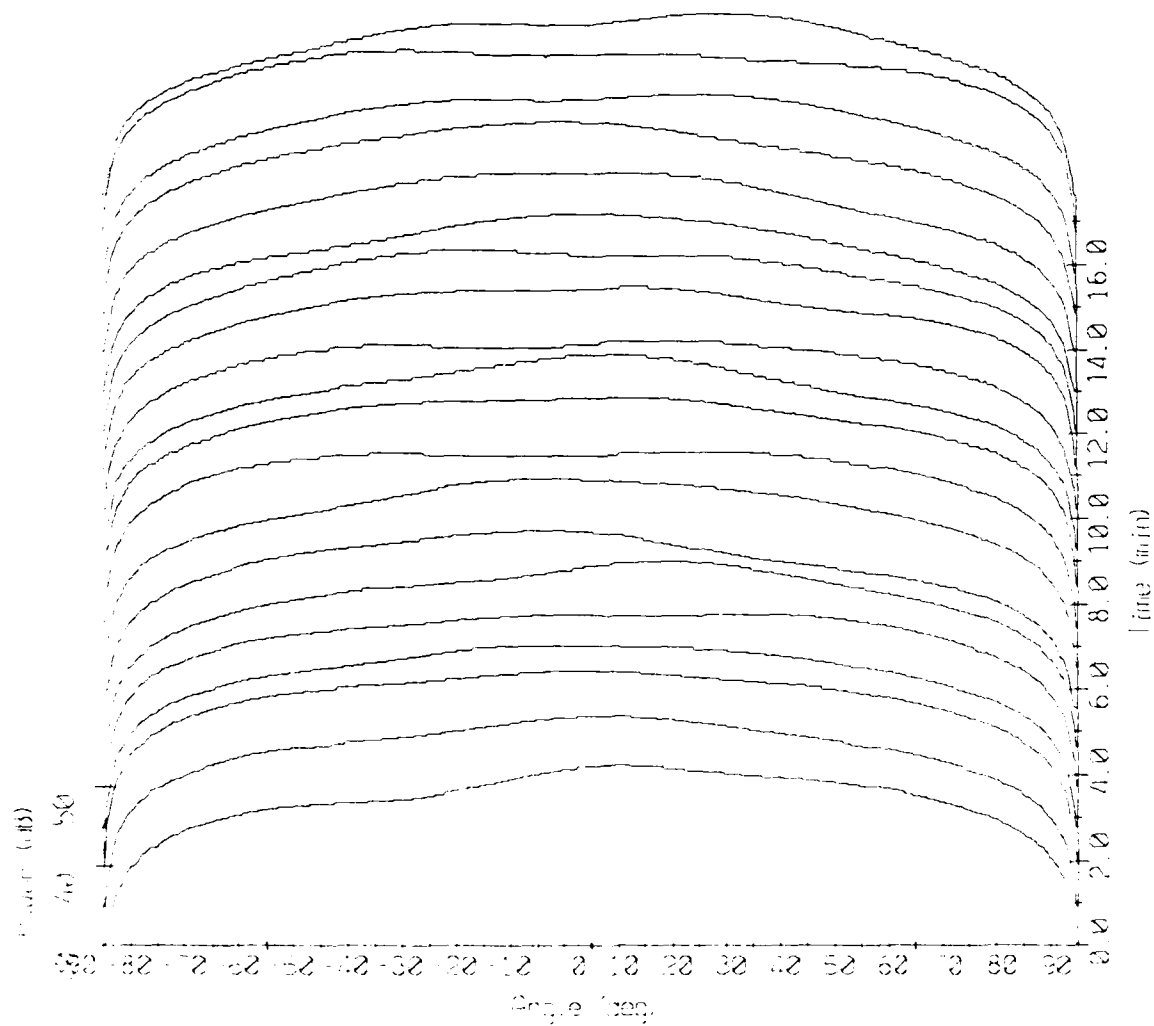


Power Spectrum 861841

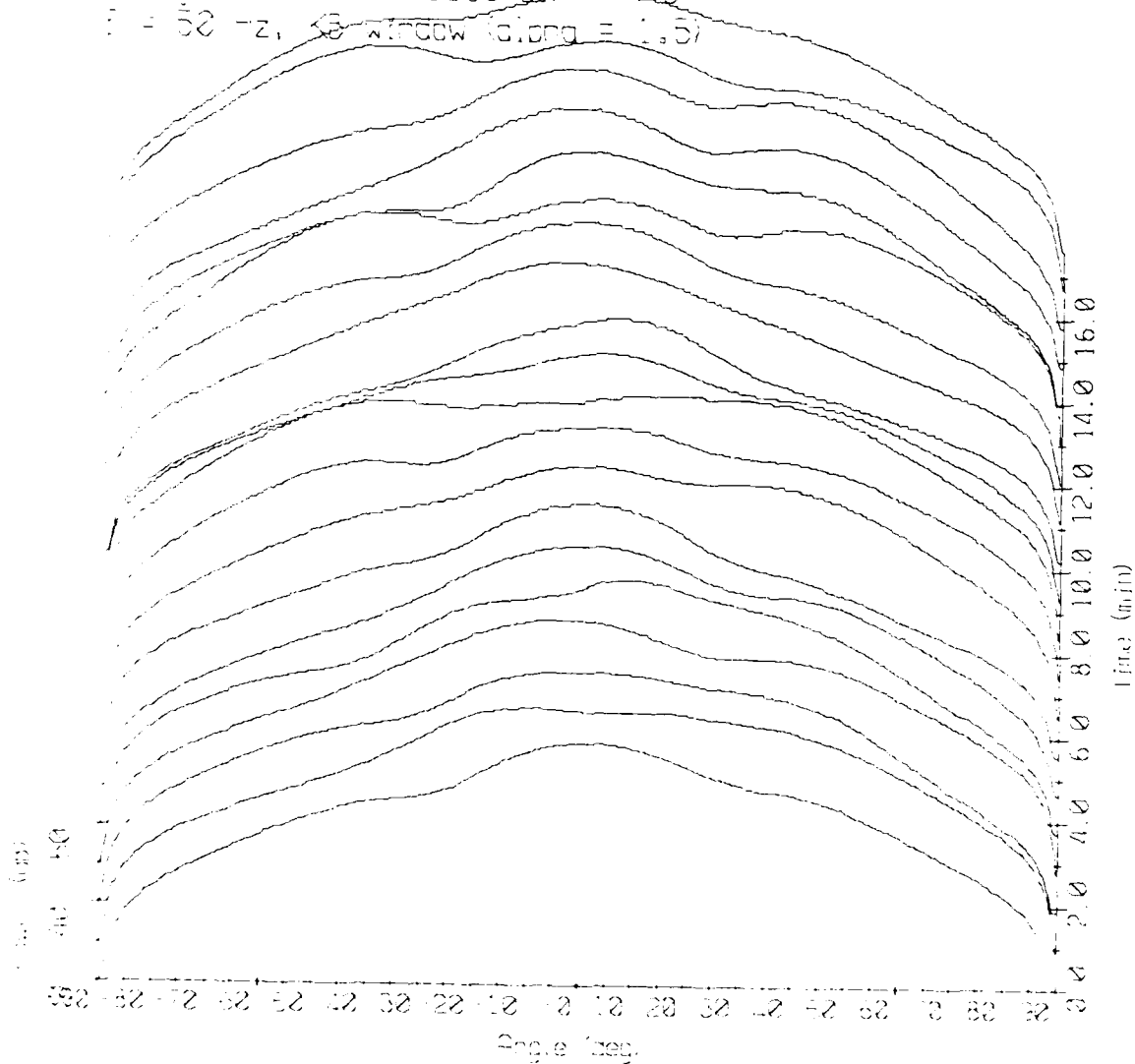


IV. Array Response: Waterfall, KB Window.

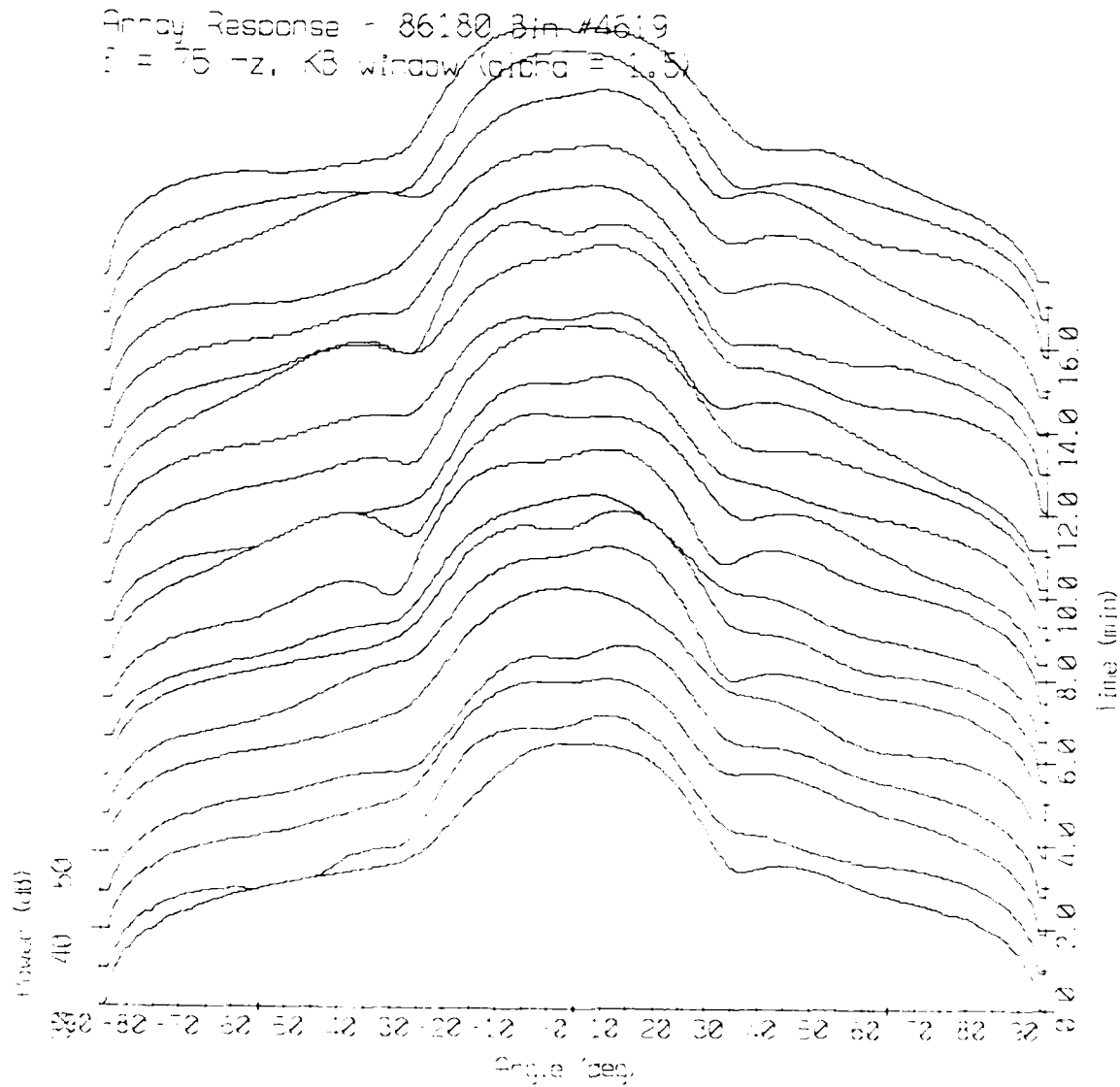
Array Response - 86180 Bin #4271
 $f = 25$ Hz, Δf window (alone) = 1.5



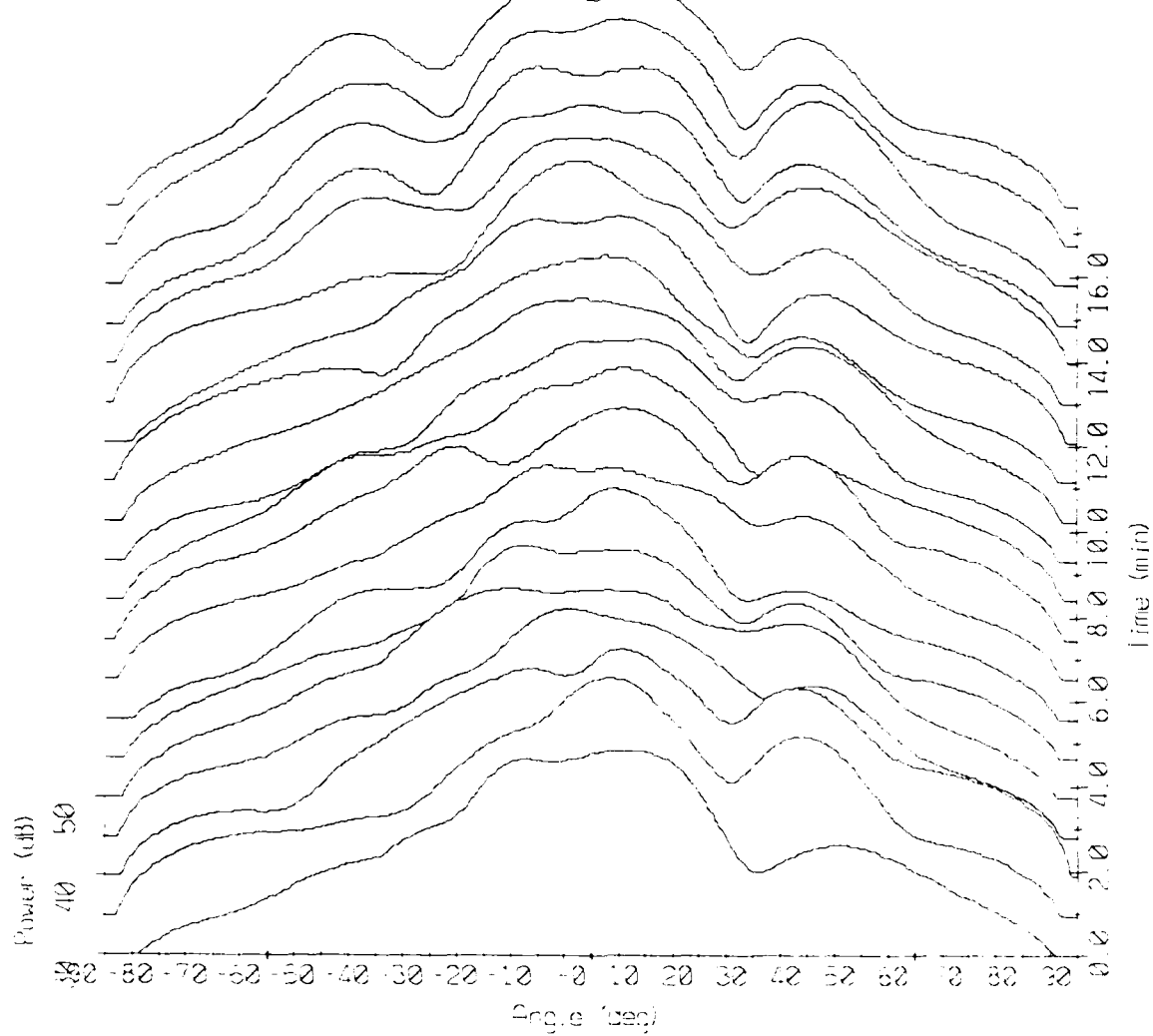
Cond. Response - 86180 B/A #4445
F = 50 Hz, 18 window (alpha = 1.5)



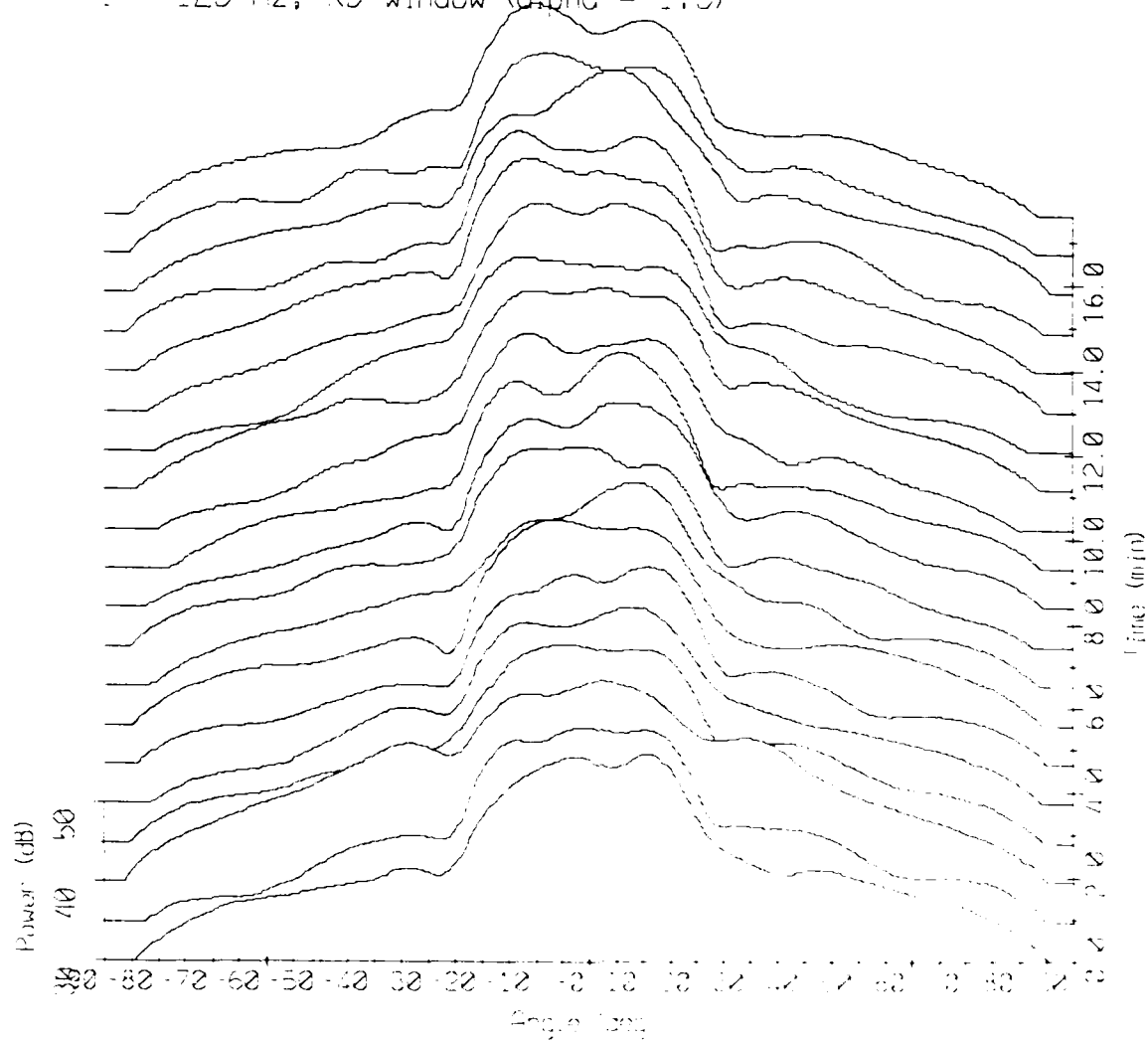
Amplitude Response - 86180 Bin #4619
 $f = 75$ Hz, KB window (alpha = 1.5)



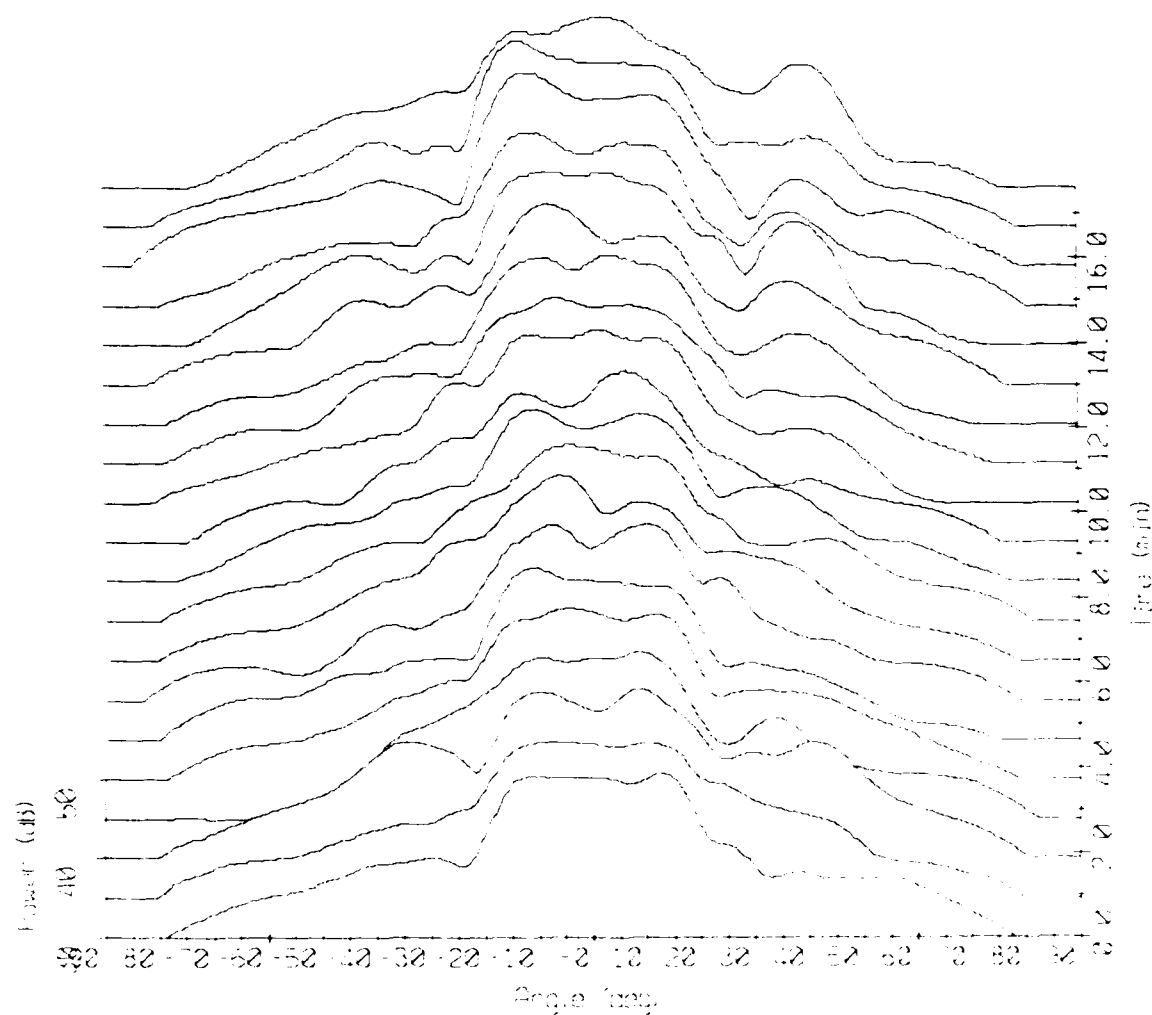
Array Response - 86180 Bin #4793
 $f = 100$ Hz, KB window (length = 1.5)



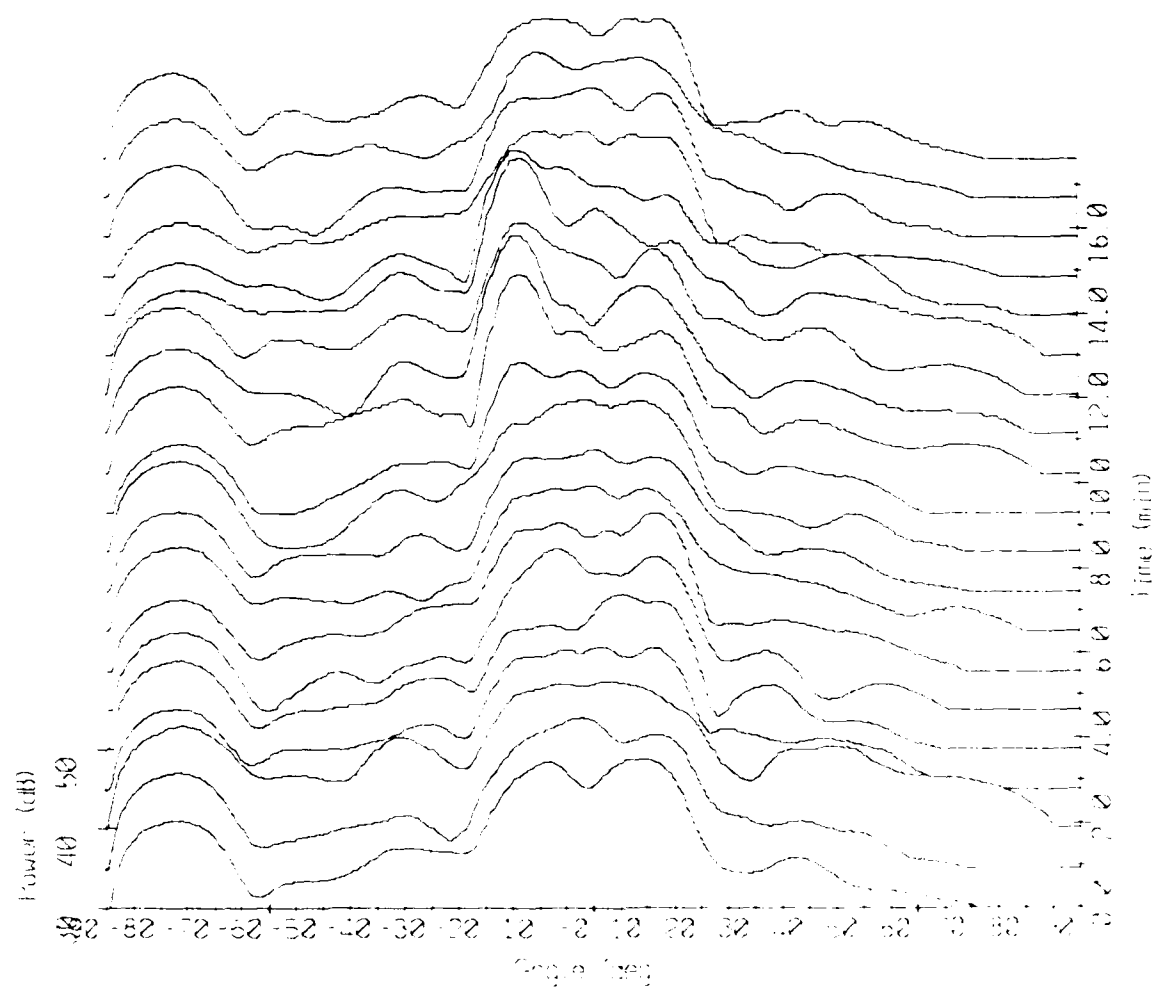
Array Response - 86180 Bin #4967
 $f = 125$ Hz, KB window ($\alpha = 1.5$)



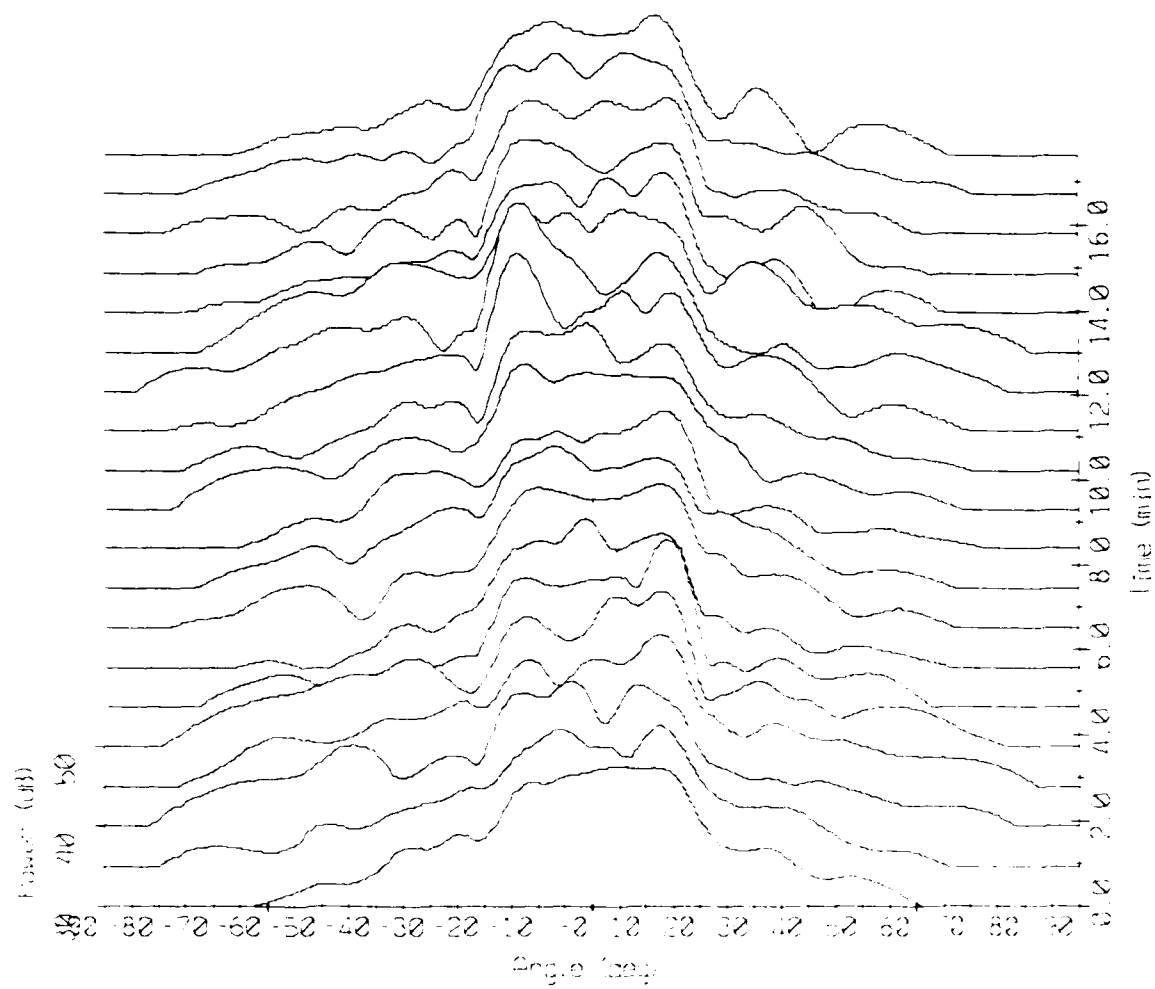
Array Response - 86180 Bin #5141
 $f = 150$ Hz, K8 window (alpha = 1.5)



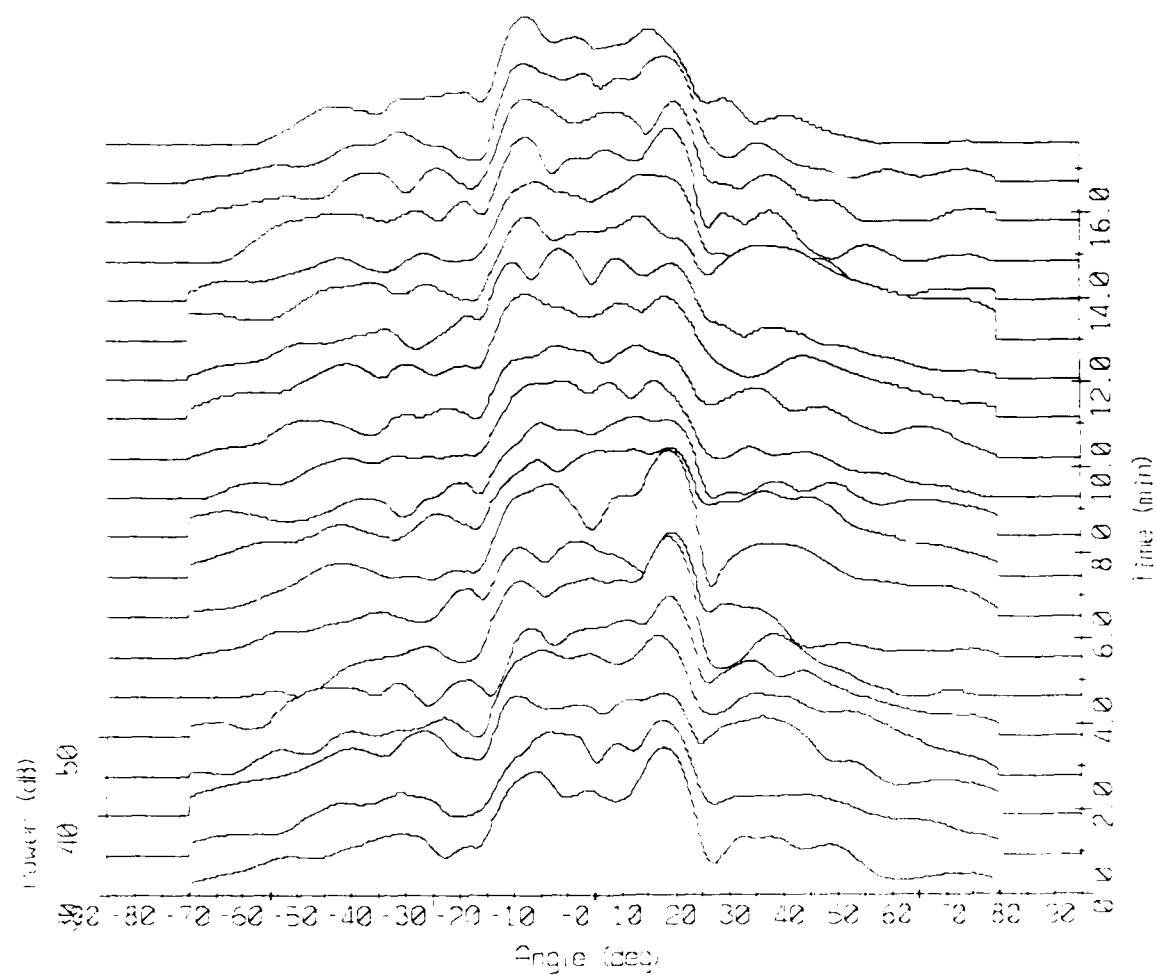
Array Response - 86180 Bin #5316
 $\beta = 1.75$ -z, K3 window (alpha = 1.5)



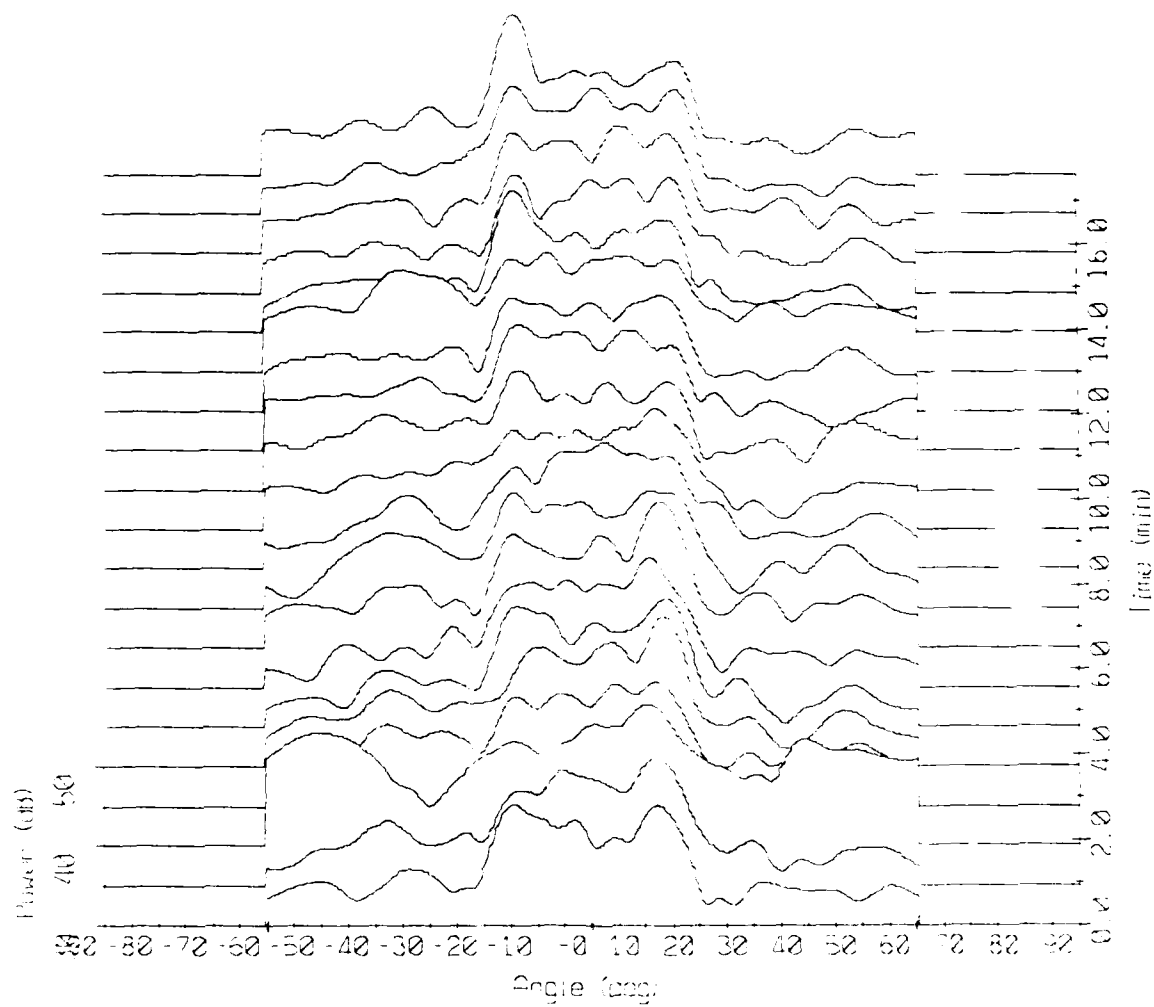
Array Response - 86180 Bin #5490
 $f = 200$ Hz, K3 window (alpha = 1.5)



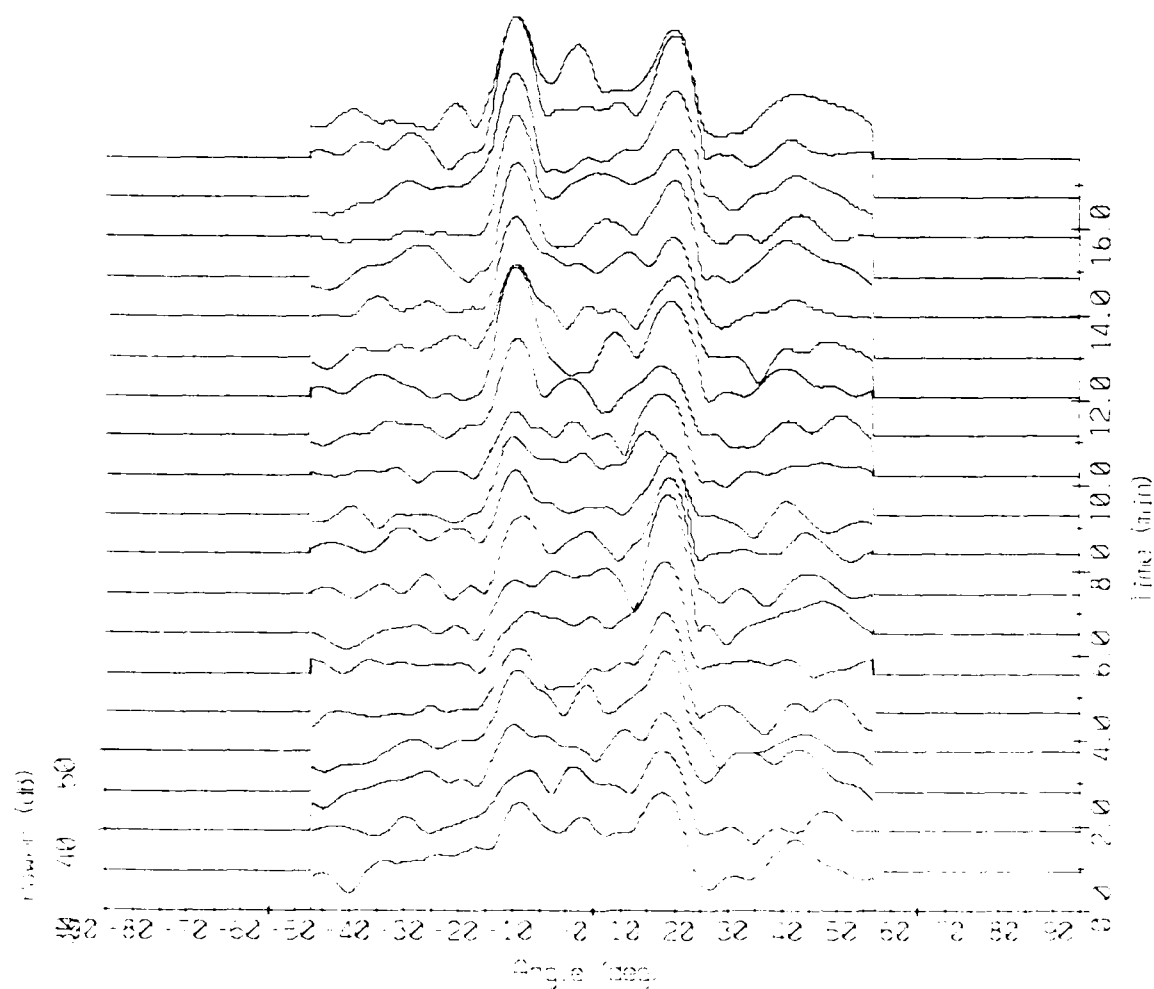
Grndy Response - 86180 31- #5664
 $f = 225$ Hz, KB window (alpha = 1.5)



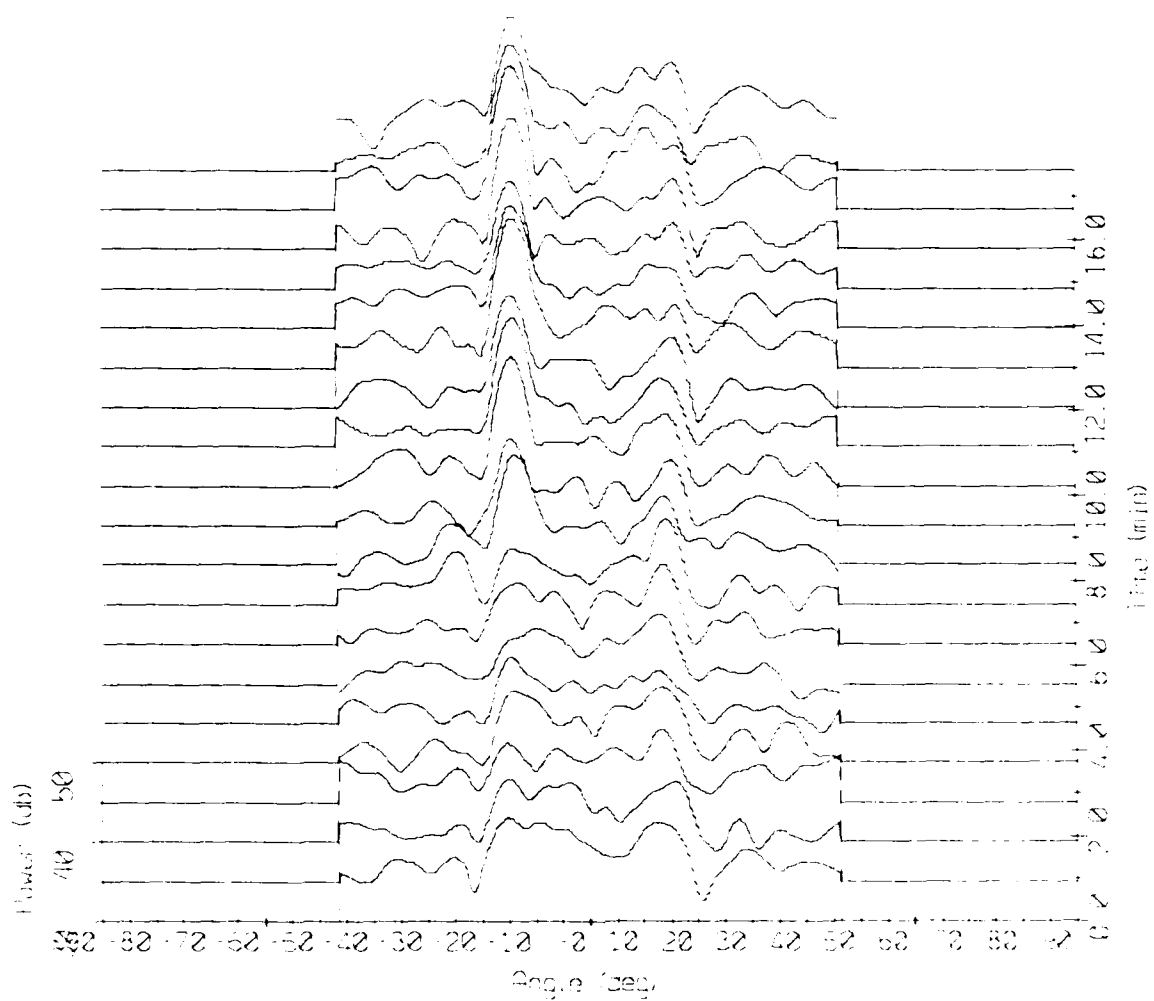
Energy Response - 86182 3in #5832
 $\lambda = 250 \text{ m}\mu$, KB window (alpha = 1.5)



Energy Response - 86180 Bin #6012
 $f = 275$ Hz, Δf window (alpha = 1.5)

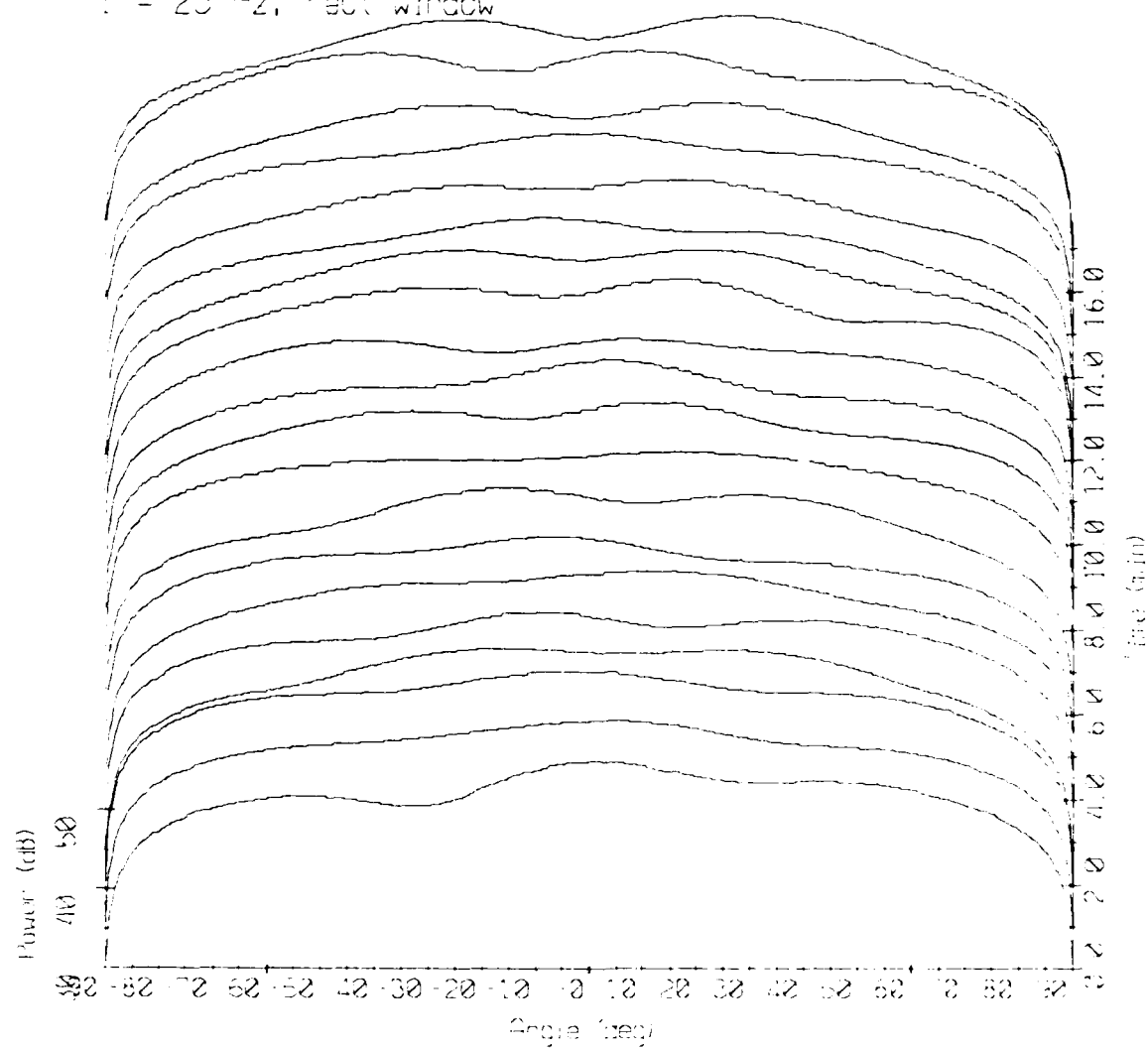


Beam Response - 86180 3in #6186
 $f = 320$ Hz, Δf window (alpha = 1.5)

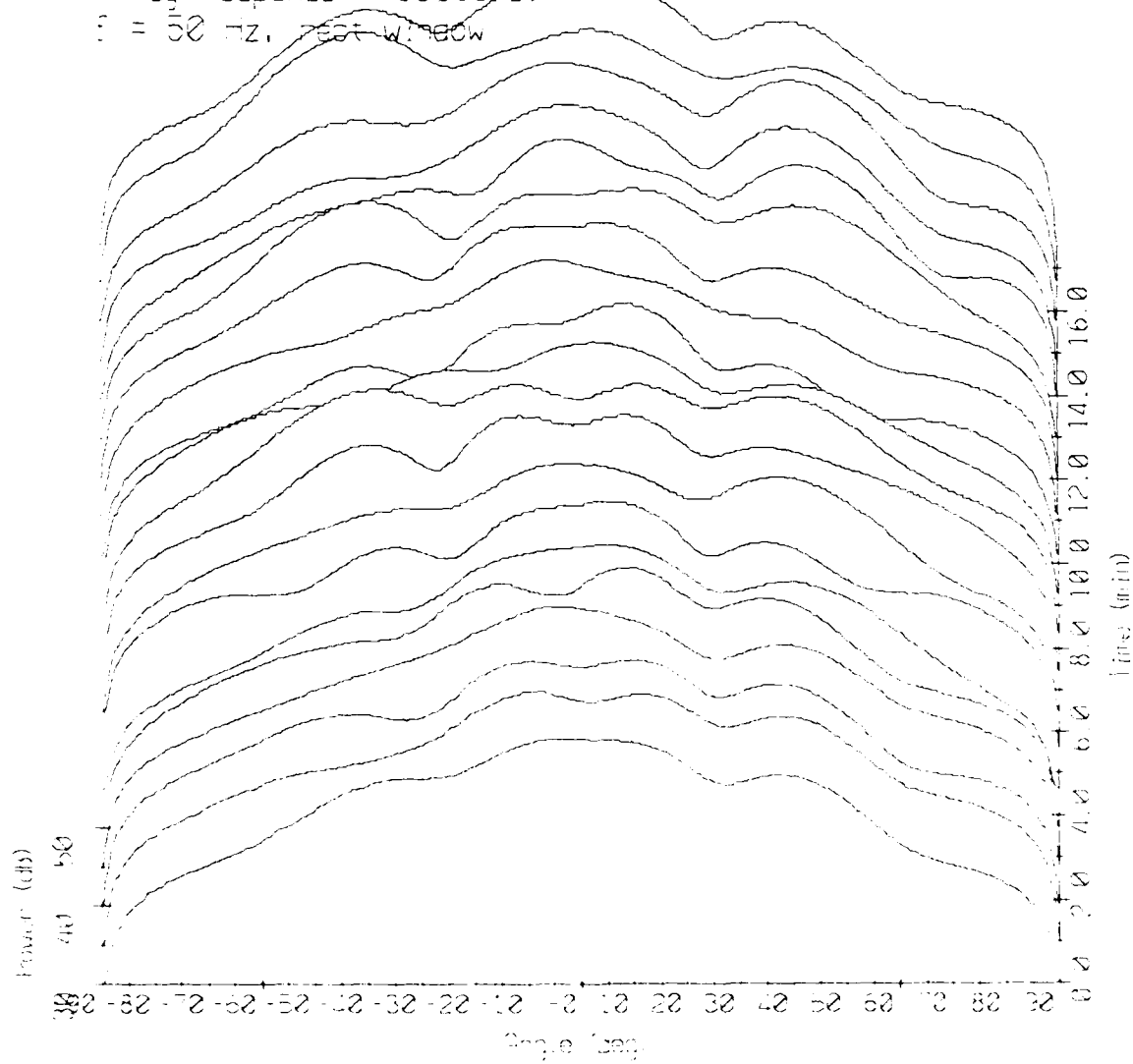


V. Array Response: Waterfall, Rect Window.

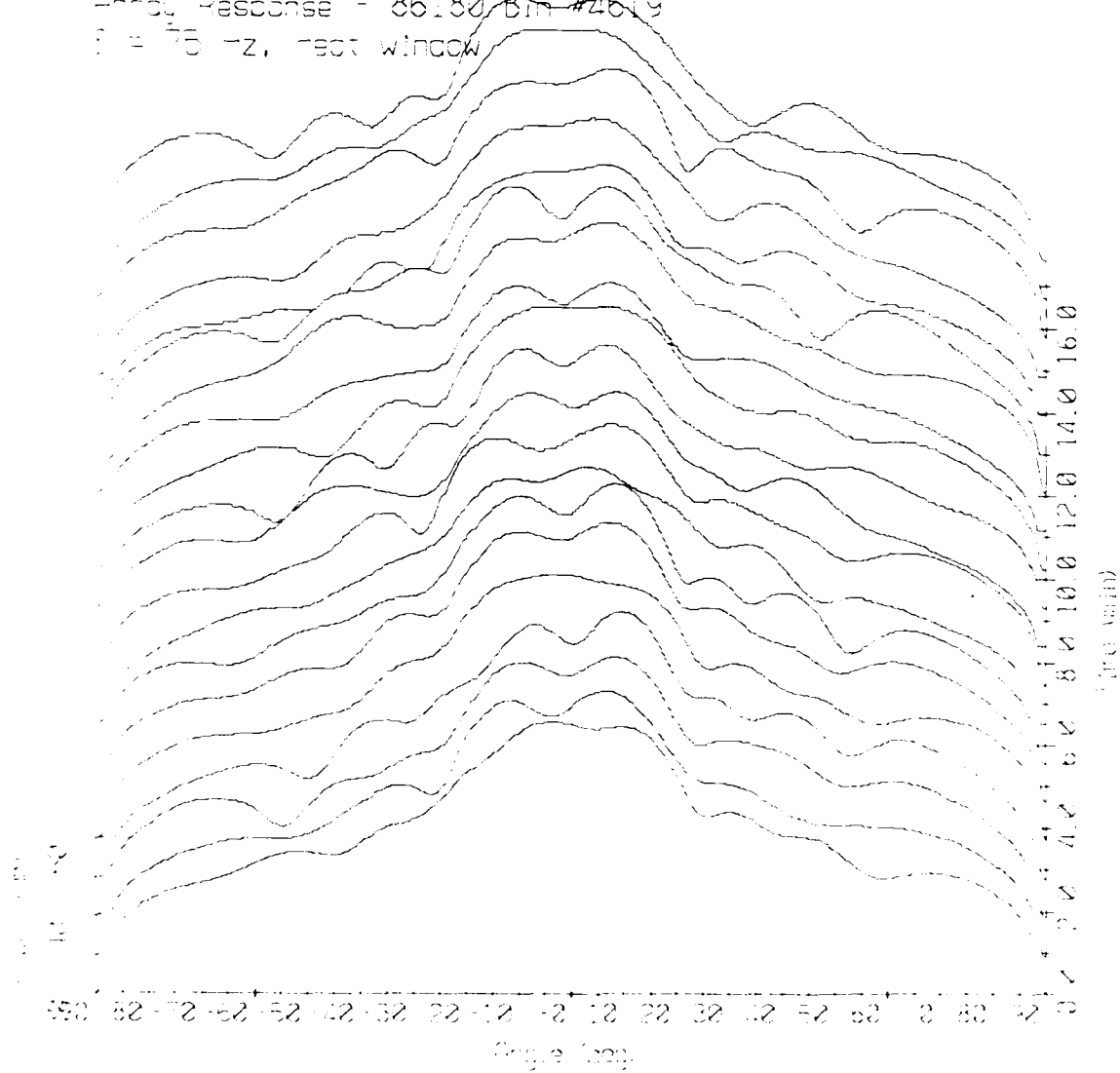
Array Response - 86180 Bin #4271
 $f = 25$ Hz, rect window



Array Response - 86180 Bin #44445
 $f = 50$ Hz, Test Window

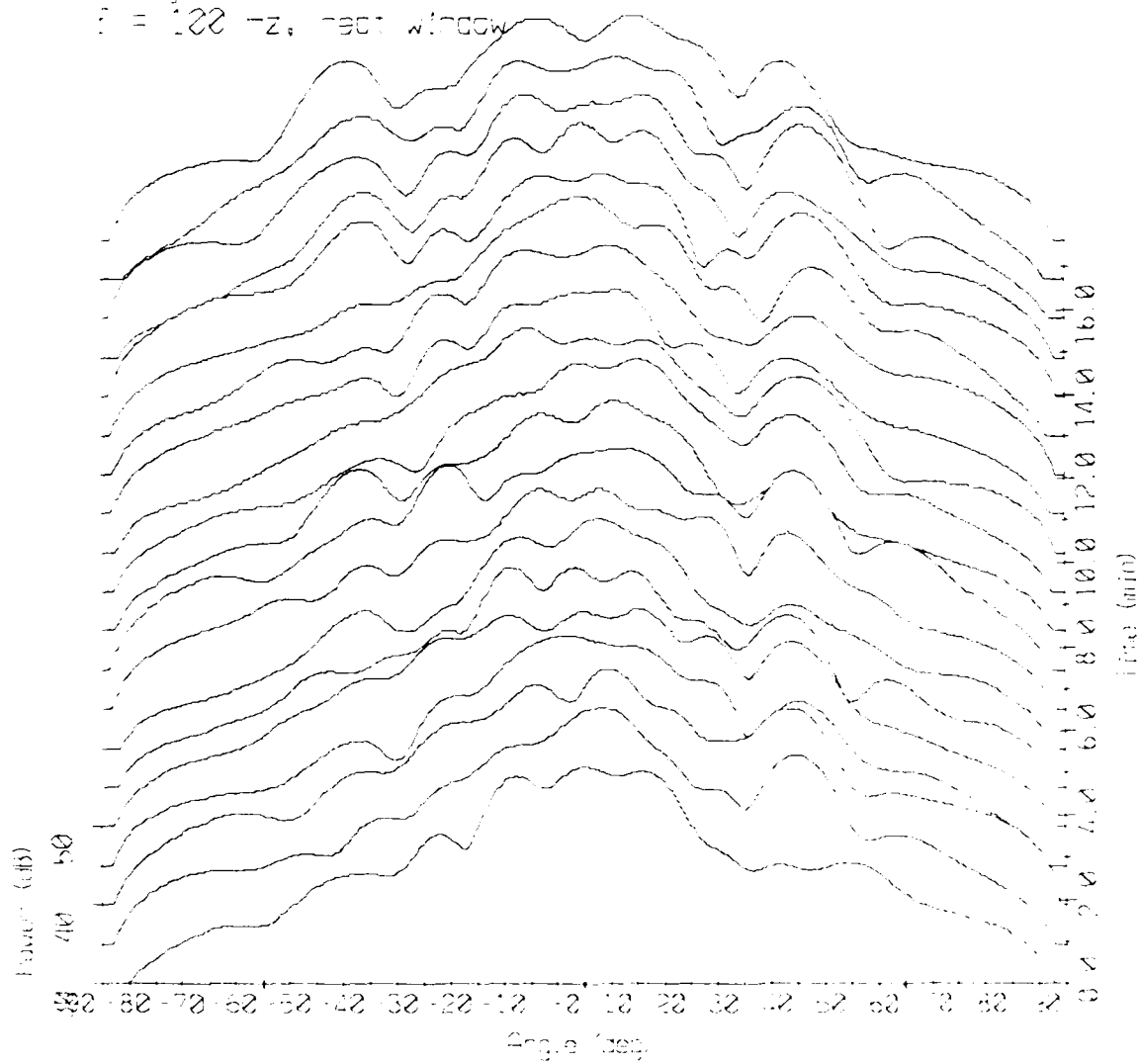


Energy Response - 86180 Bin #4519
E = 75 Hz, rest window

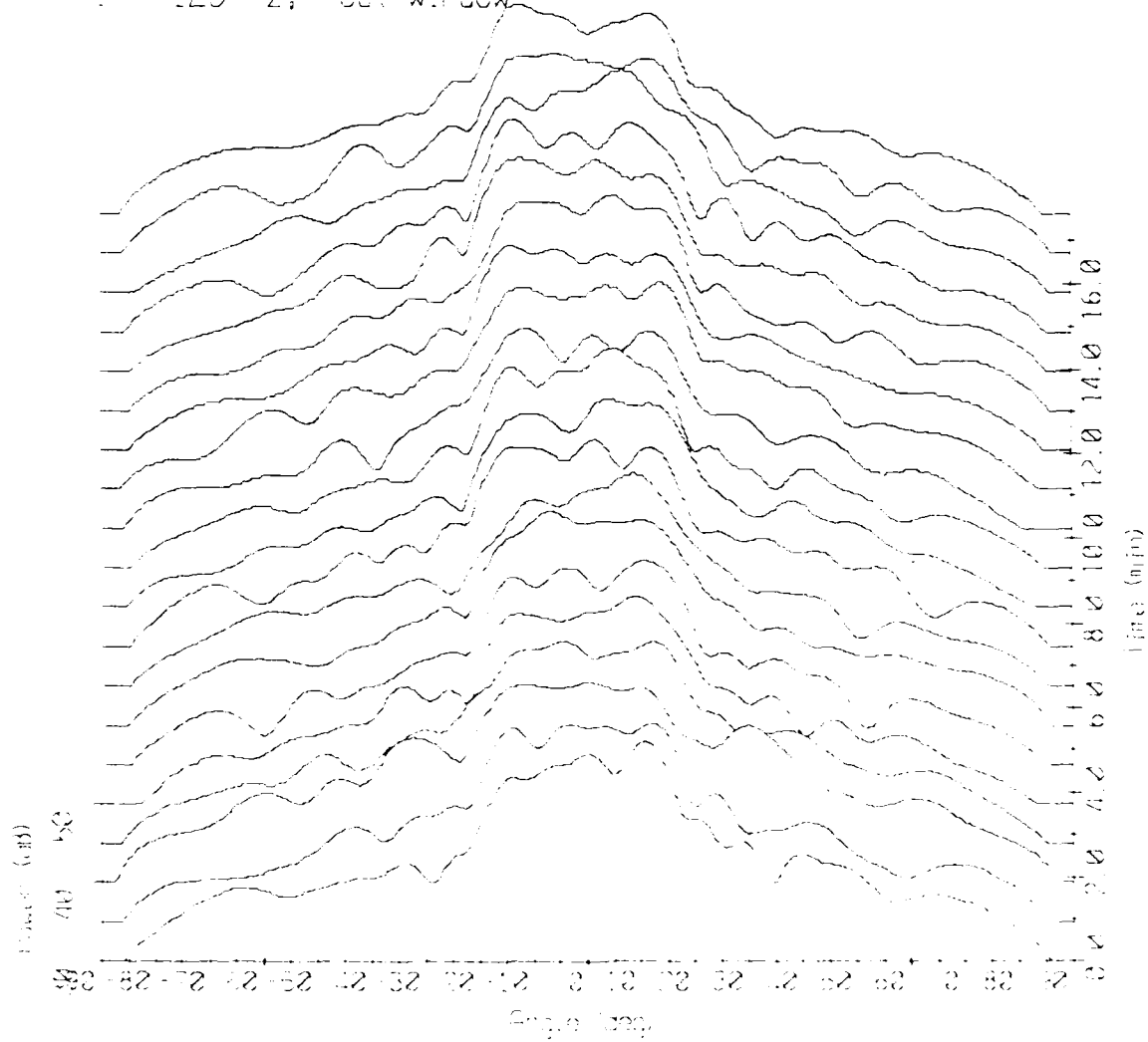


Acoustic Response - 86180 Bin #4793

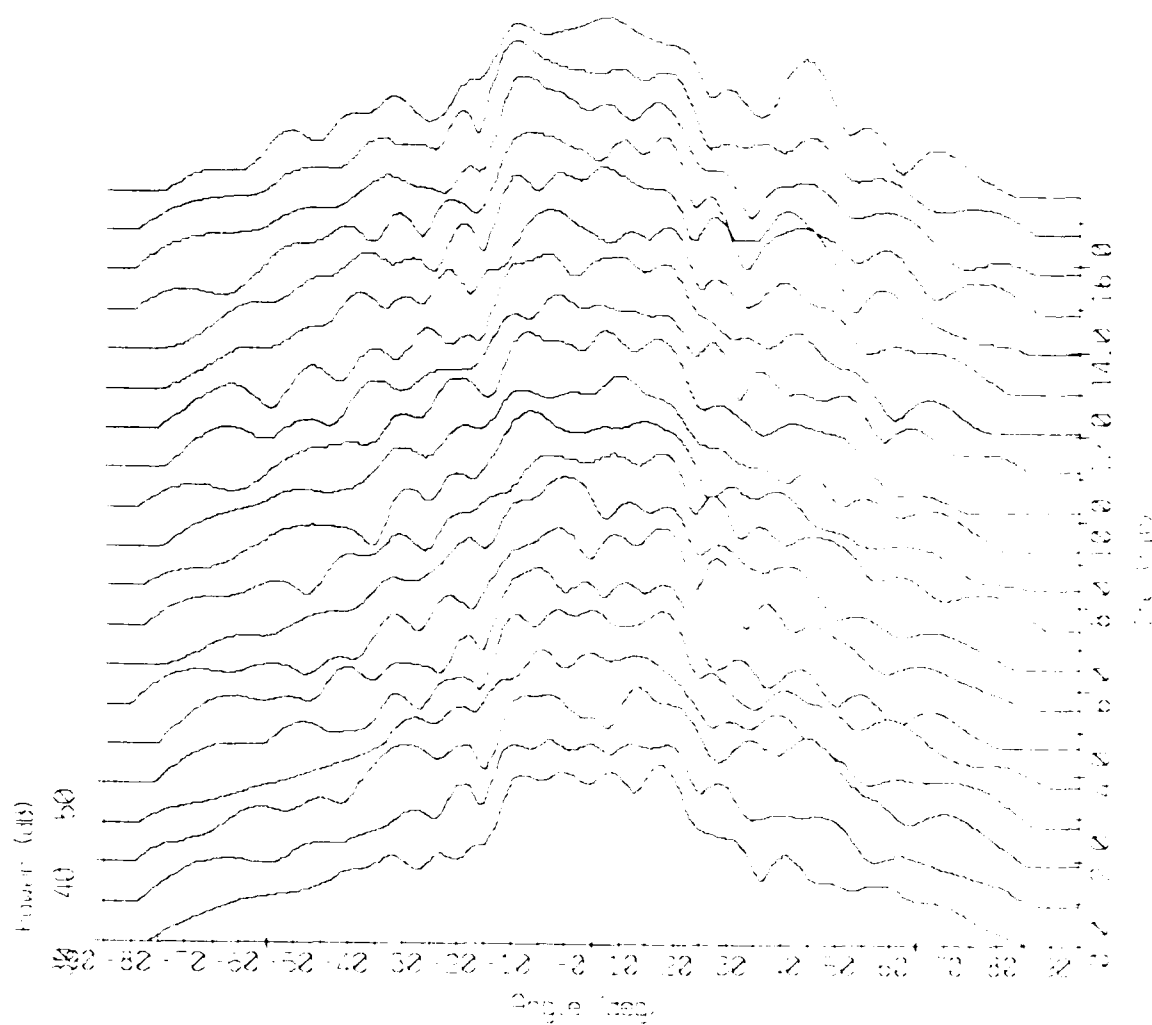
$\Delta = 120$ Hz, 1901 window



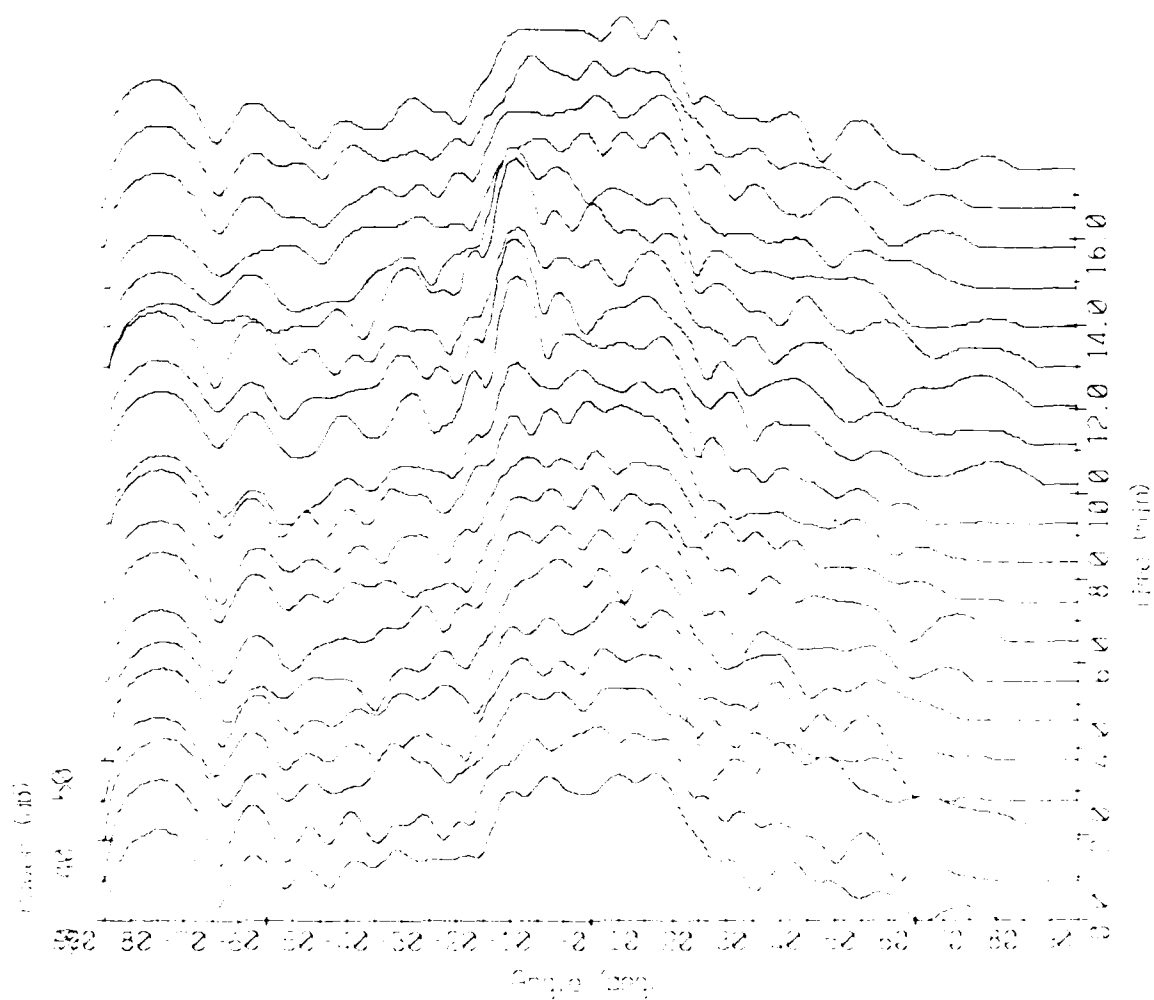
Ampl. Response - 86180 Bin #4967
 $\Delta f = 125$ Hz, rect. window



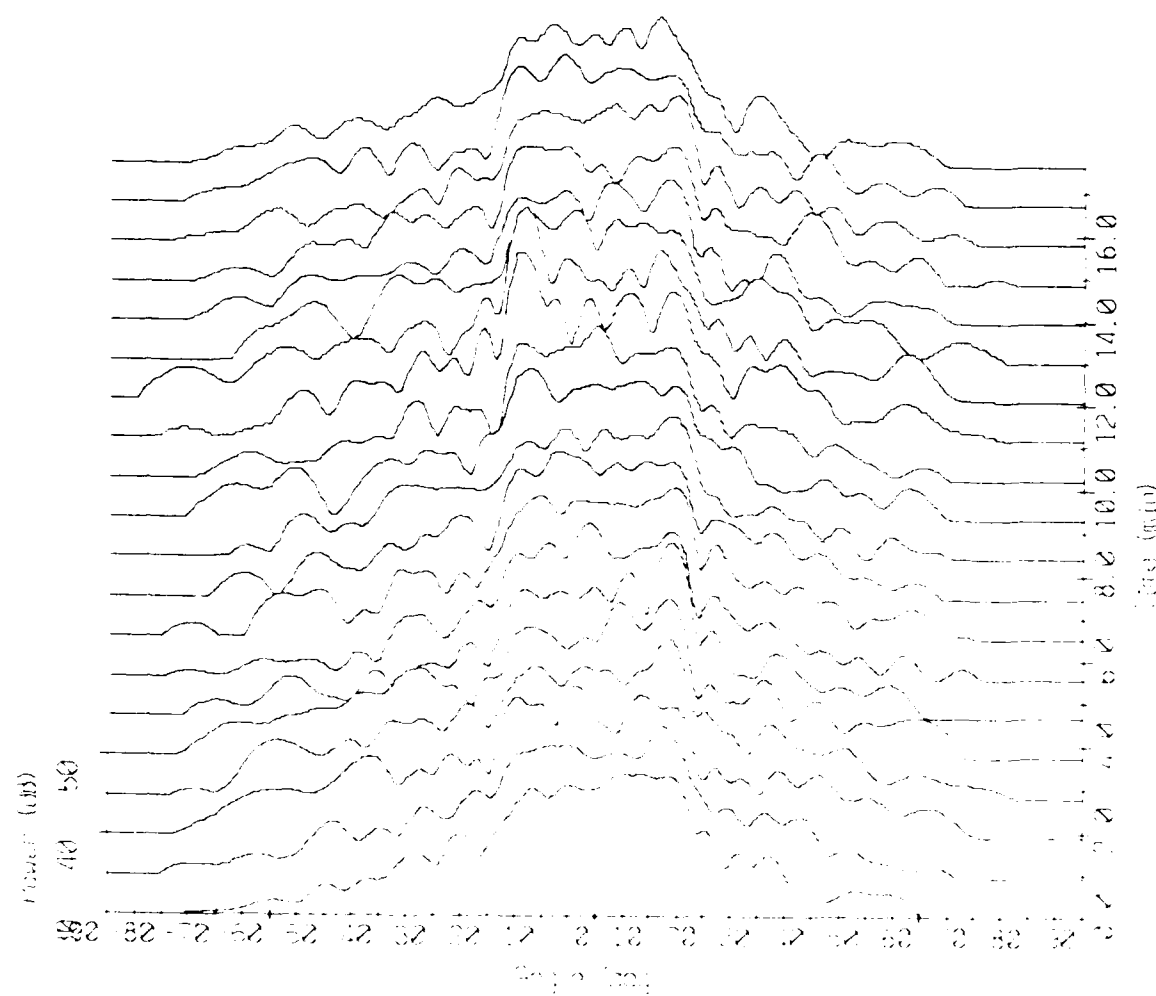
Array Response - 86180 31r #5141
f = 150 Hz, rect window



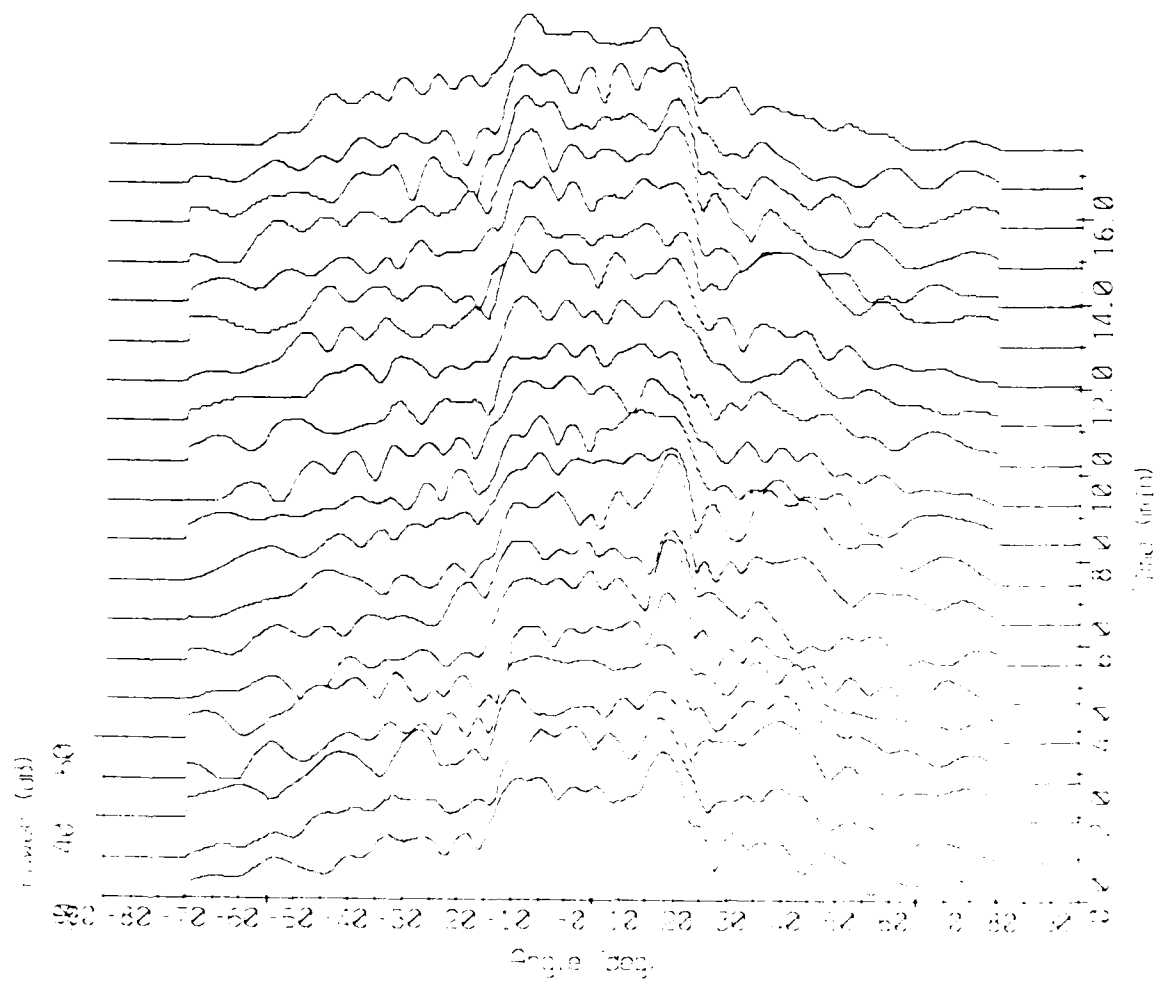
Amplitude Response - 86180 Bin #5316
 $\Delta f = 1.75$ Hz, rect. window



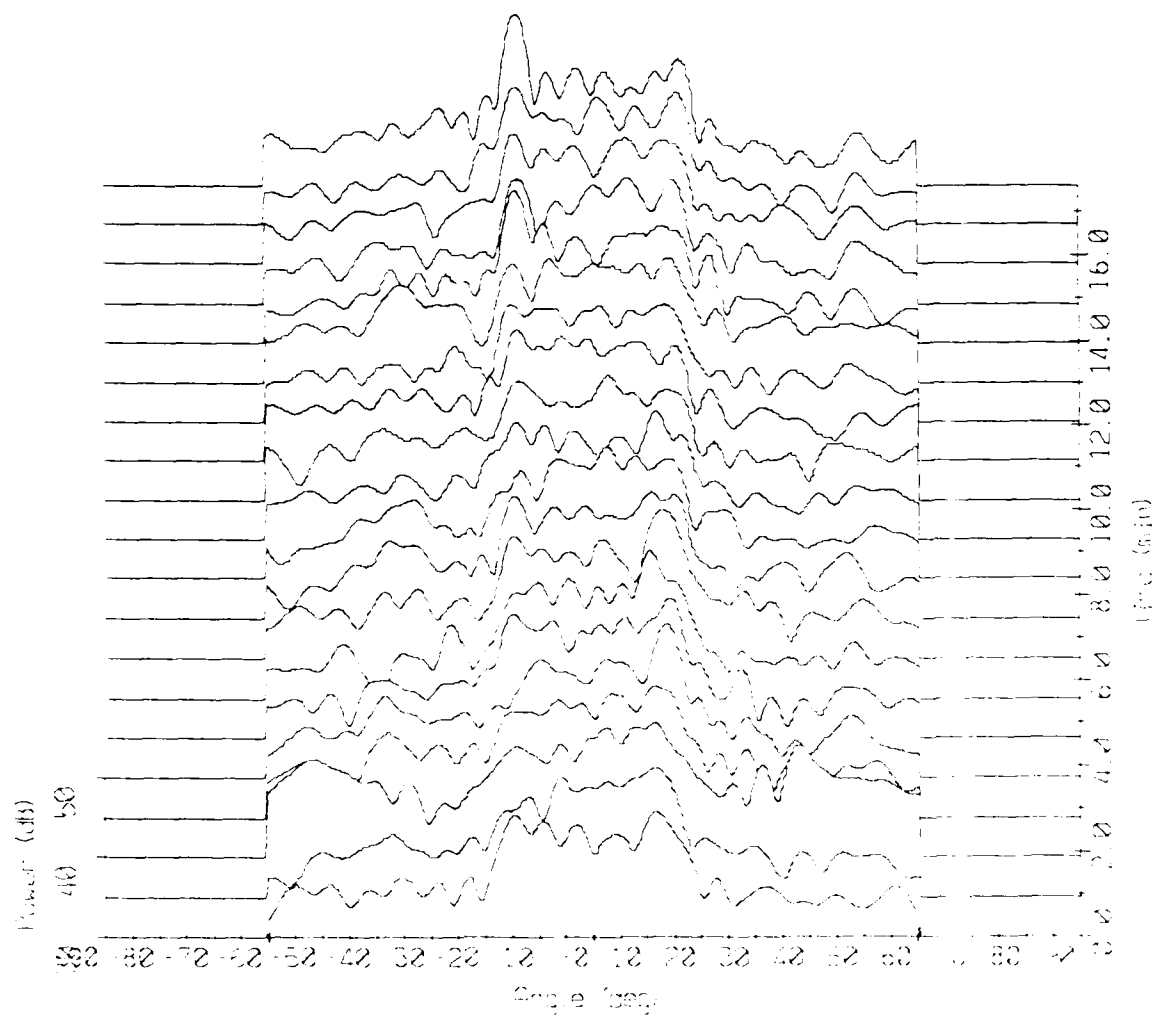
Array Response - 86180 Bin #5490
 $\Delta f = 200$ Hz, rect window



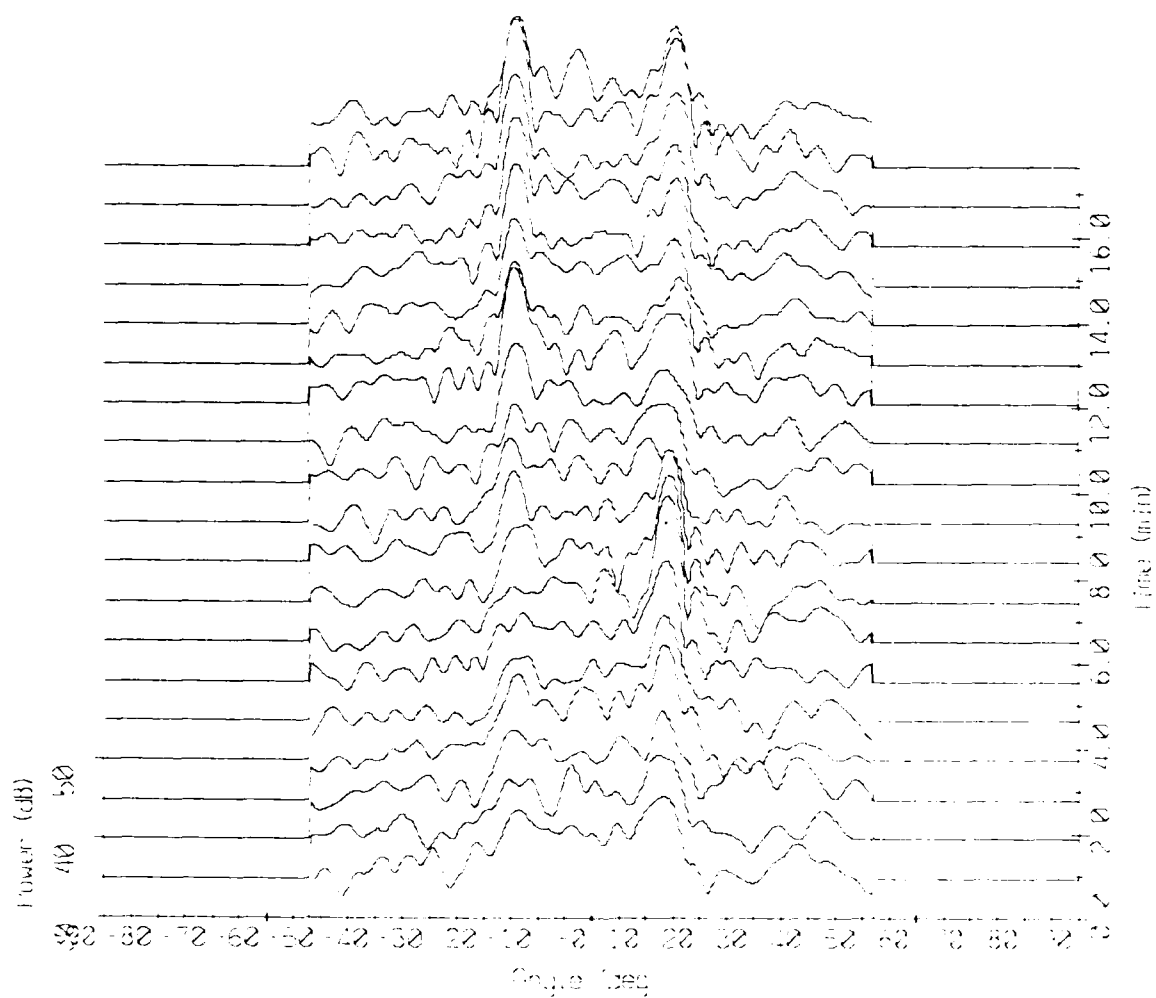
Array Response - 86180 Bin #5664
 $f = 225$ Hz, next window



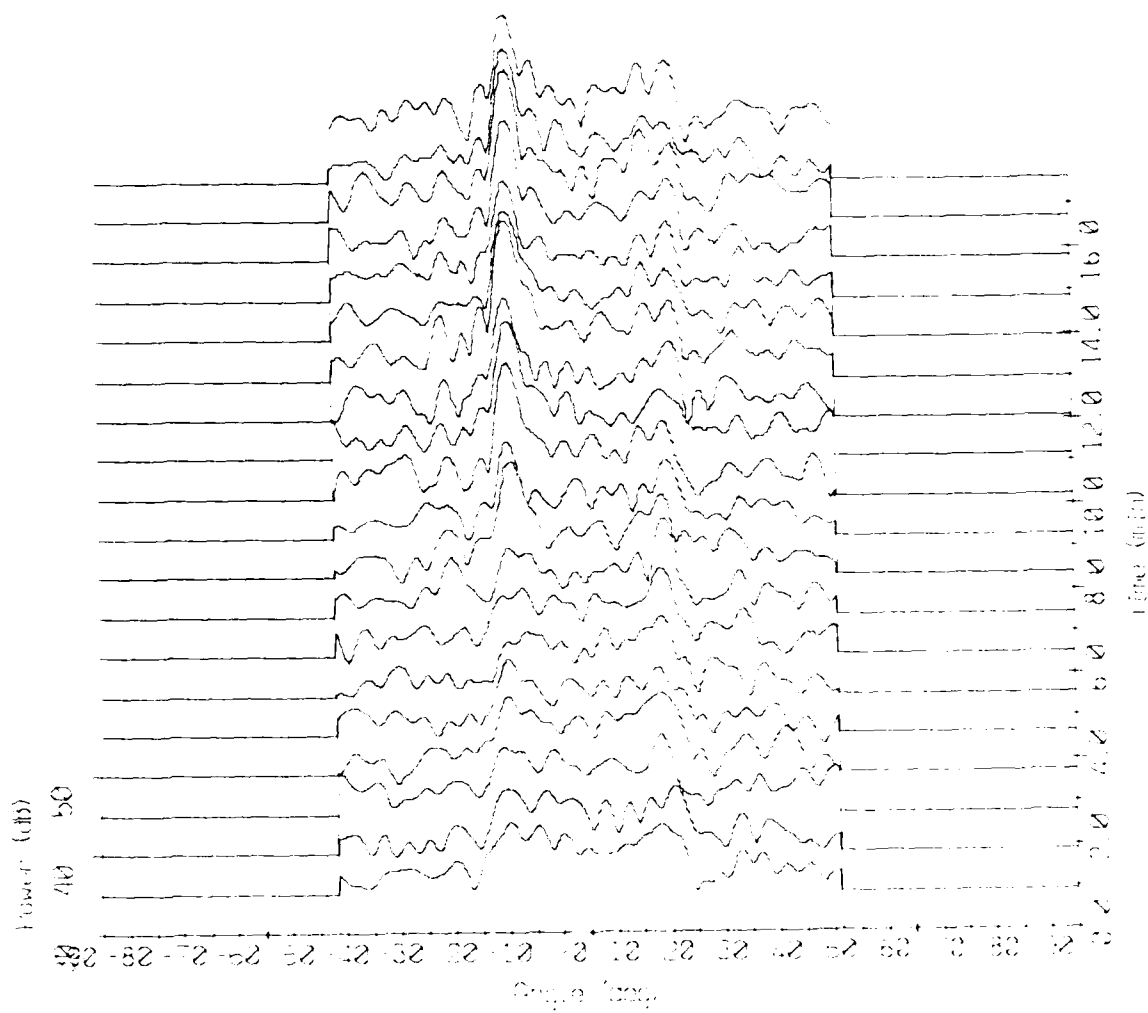
Array Response - 86180 Bin #5832
 $f = 250$ Hz, rect window



Array Response - 36180 Bin #6212
 $f = 275$ Hz, rect window



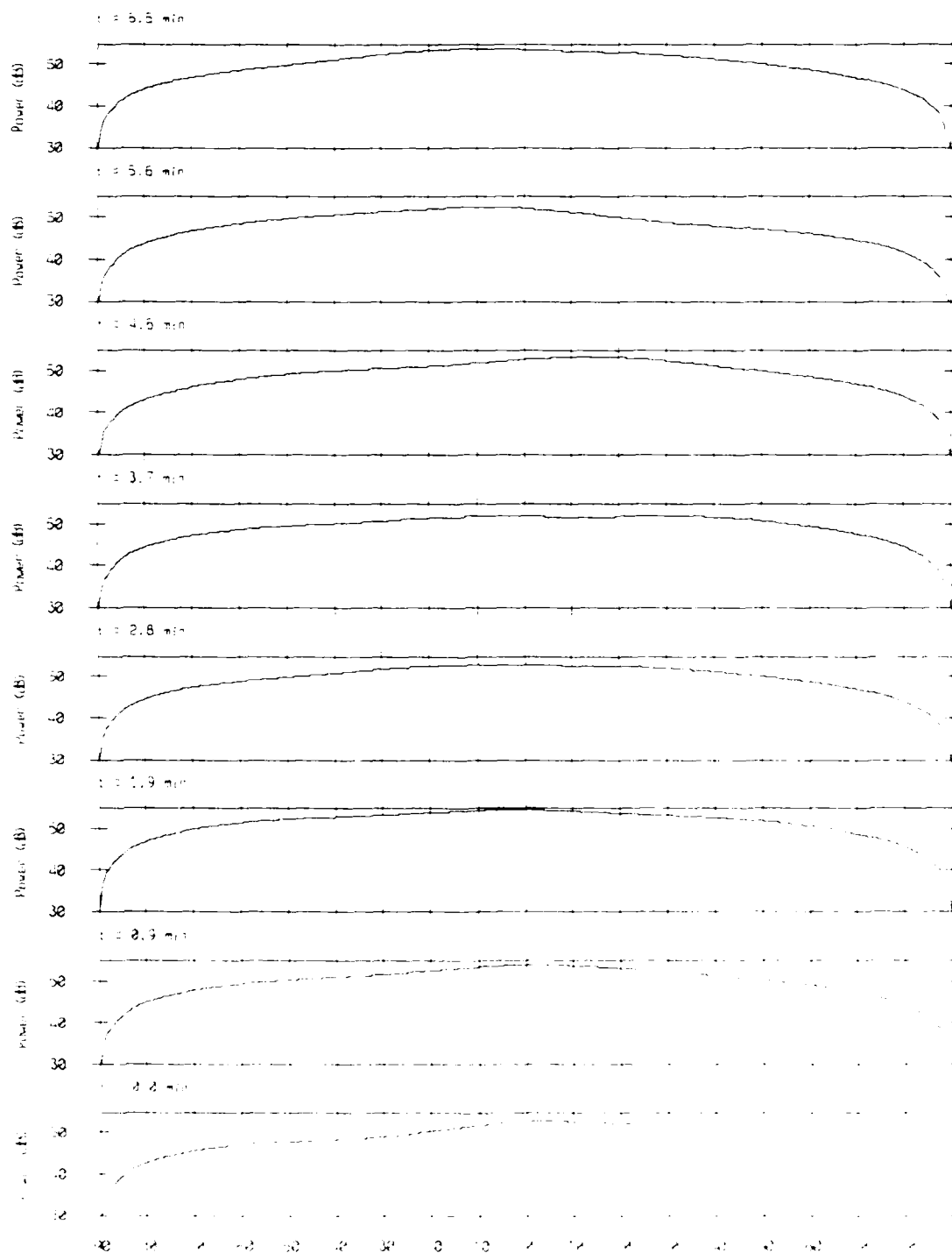
Array Response - 36180 Bin #6186
 $\Delta f = 300$ Hz, rect window

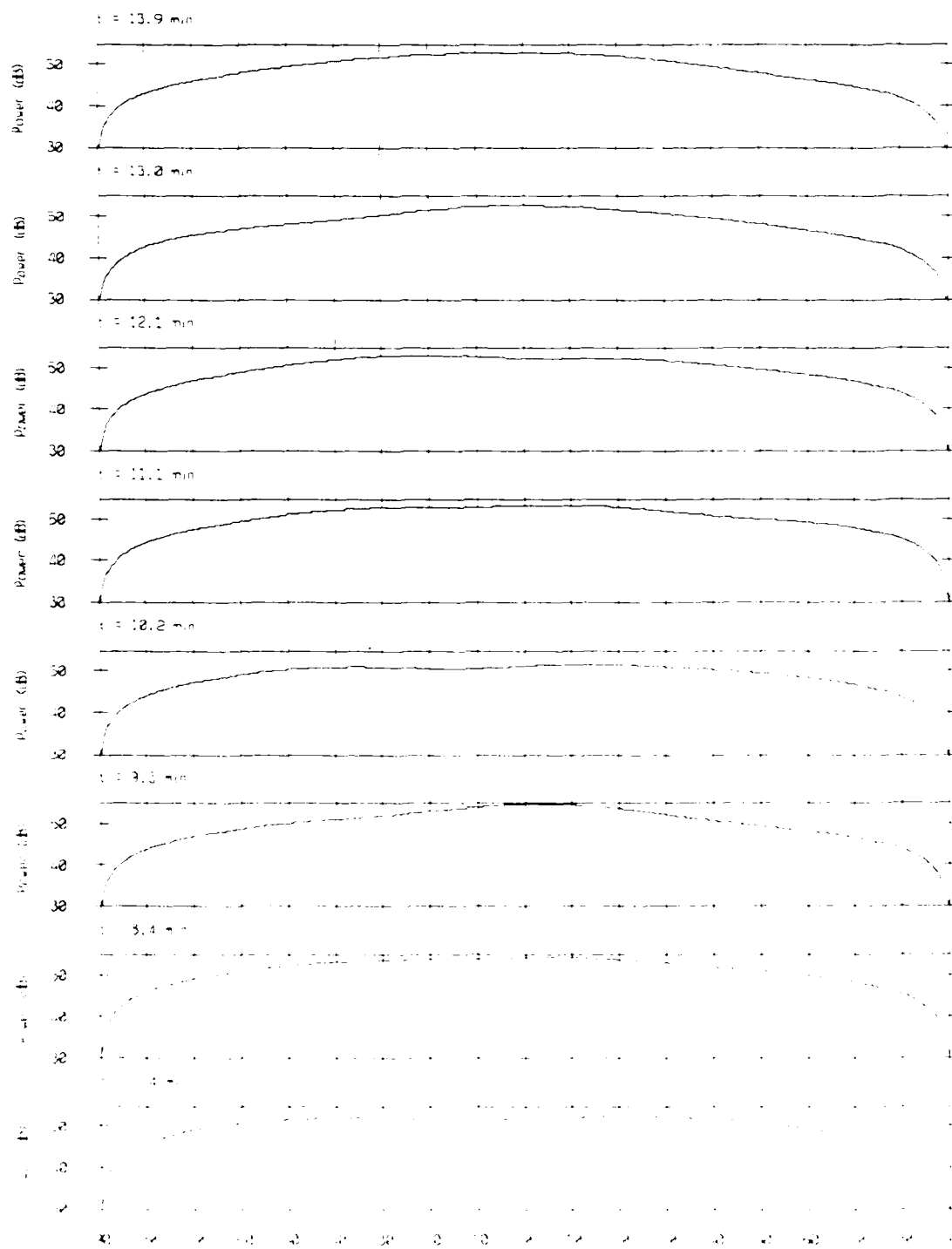


VI. Array Response: Panels, KB Window.

Array Response - 86180 3in #4271

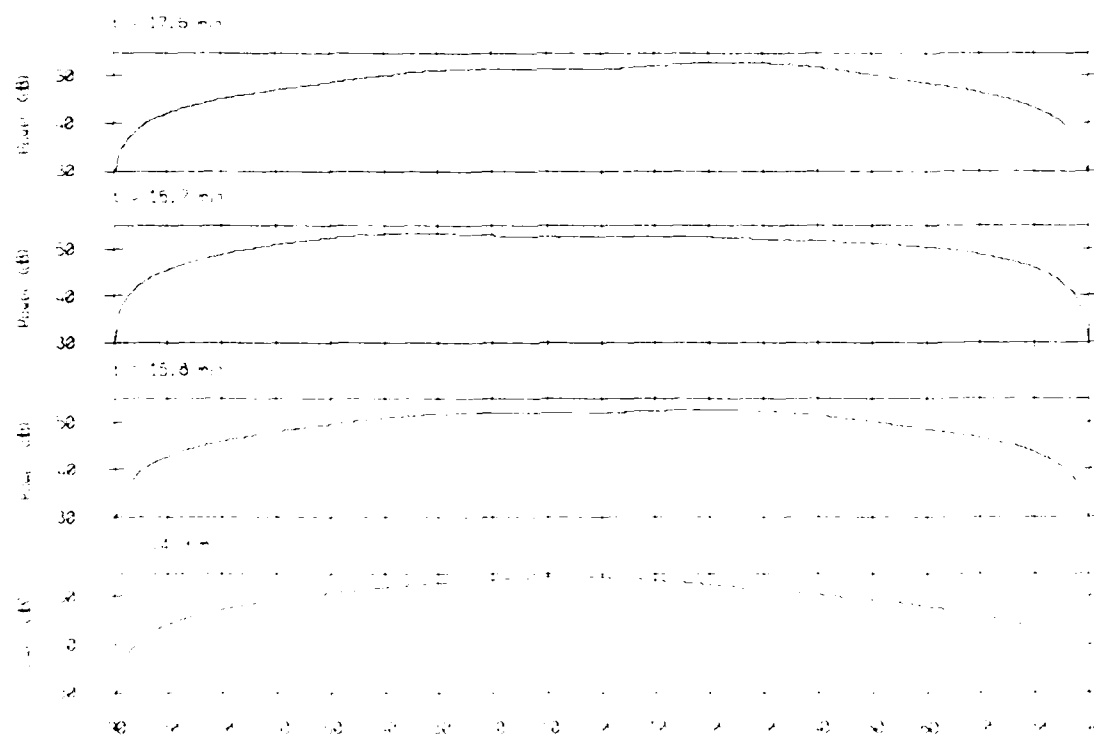
$f = 25$ Hz, ΔB window (plane = 1.5)



$$f = 25 - z, \quad \text{4B window (a.pnc = 1.5)}$$


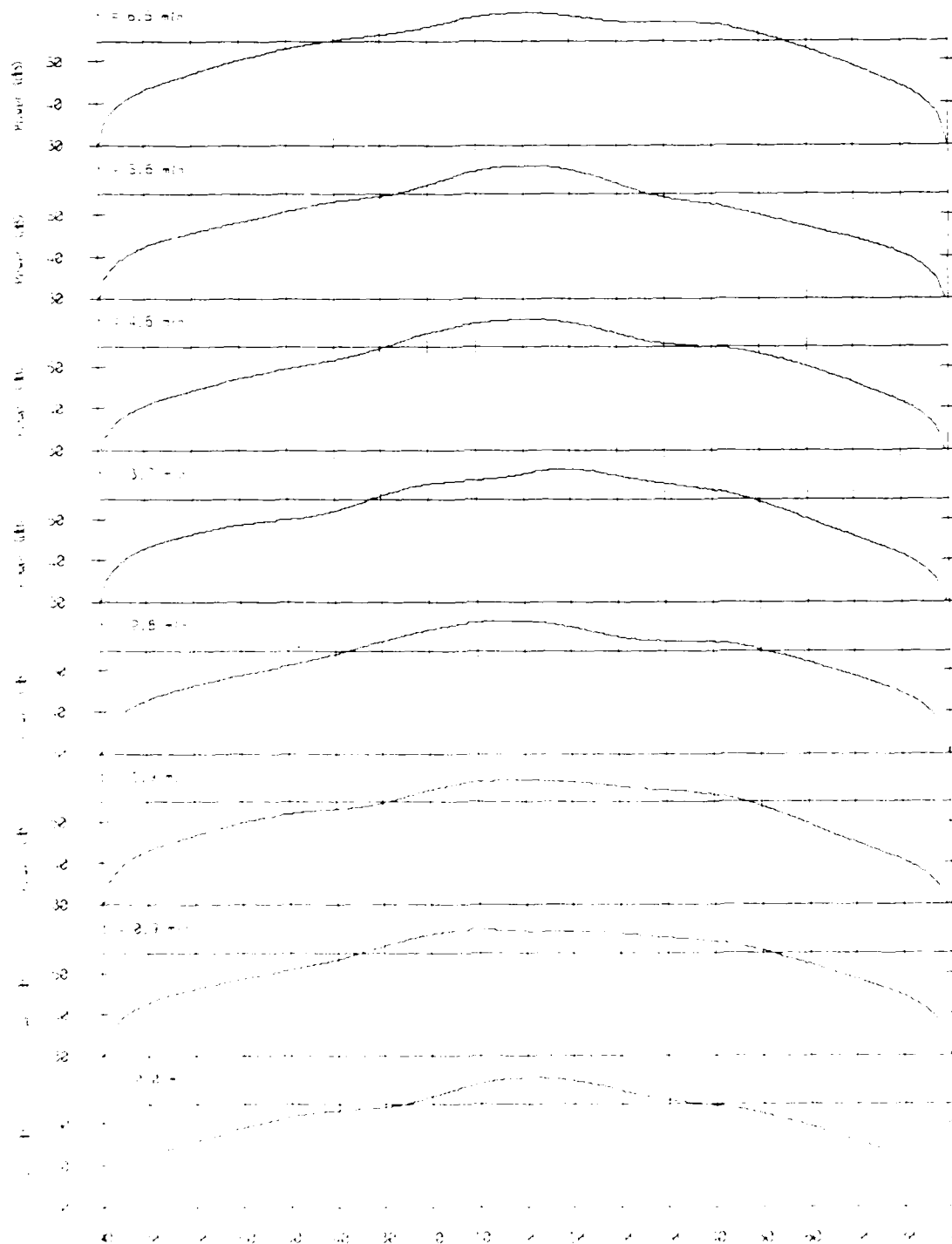
Array Response - 86180 3in #4271

$f = 25$ Hz, ΔB window (alpha = 1.5)



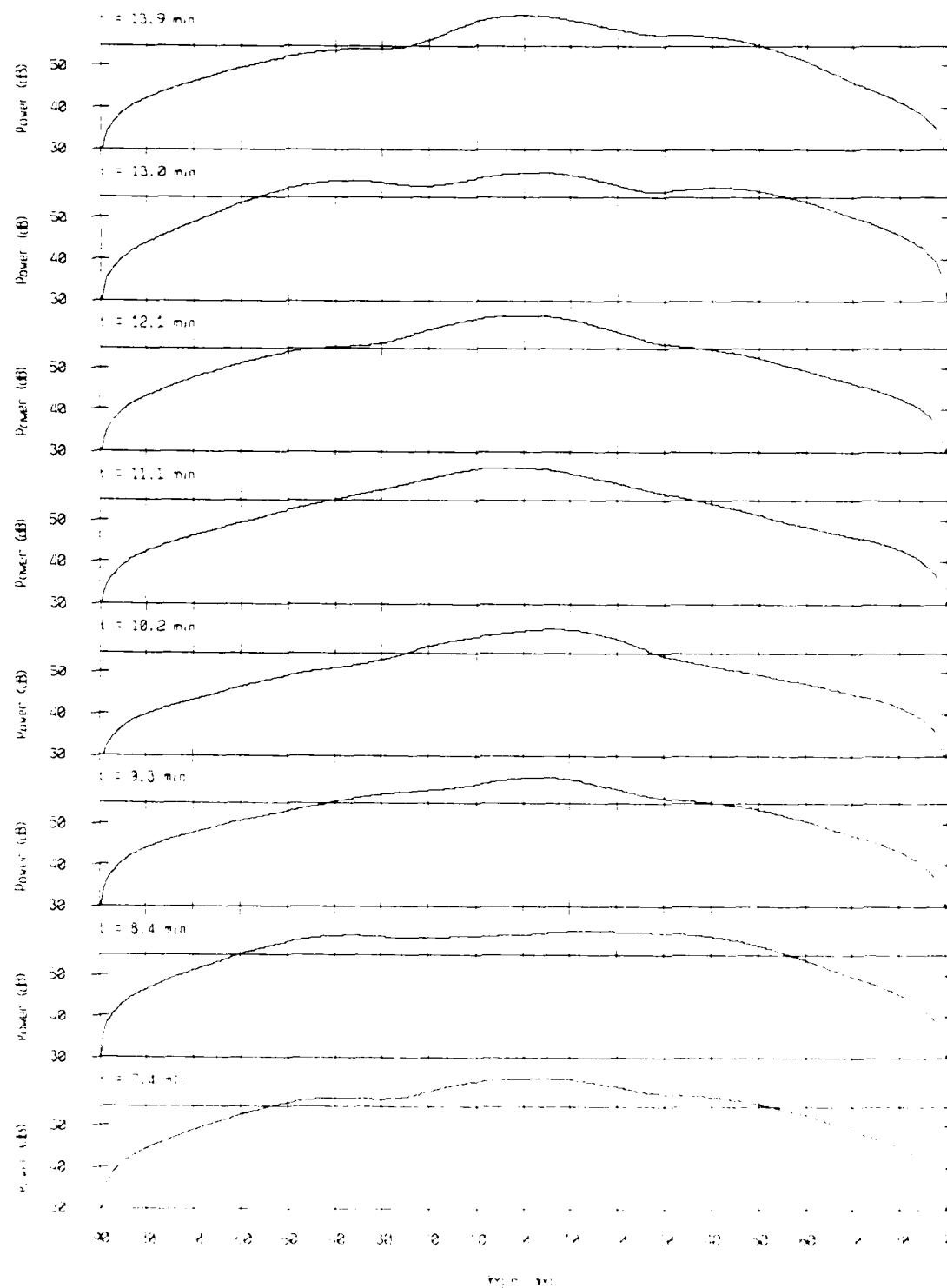
Array Response - 86180 3in #4445

$f = 50$ Hz, ΔB window (sigma = 1.5)



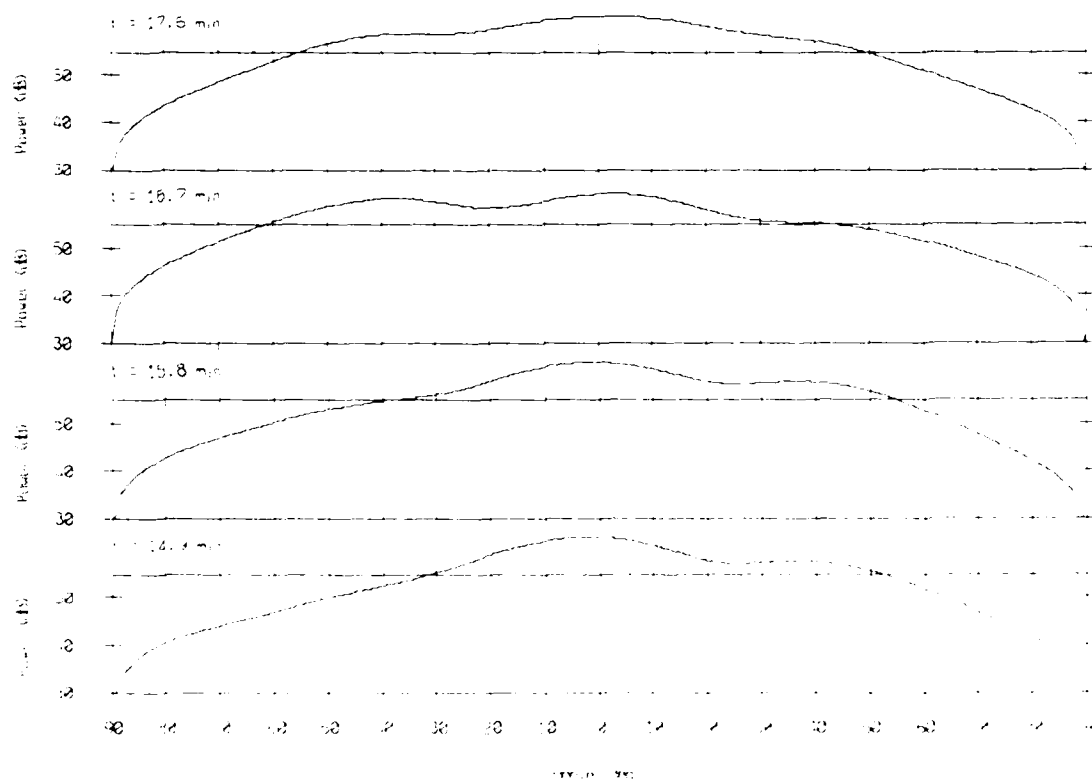
Array Response - 86180 Bin #4445

$f = 50$ Hz, 4B window (alpha = 1.5)



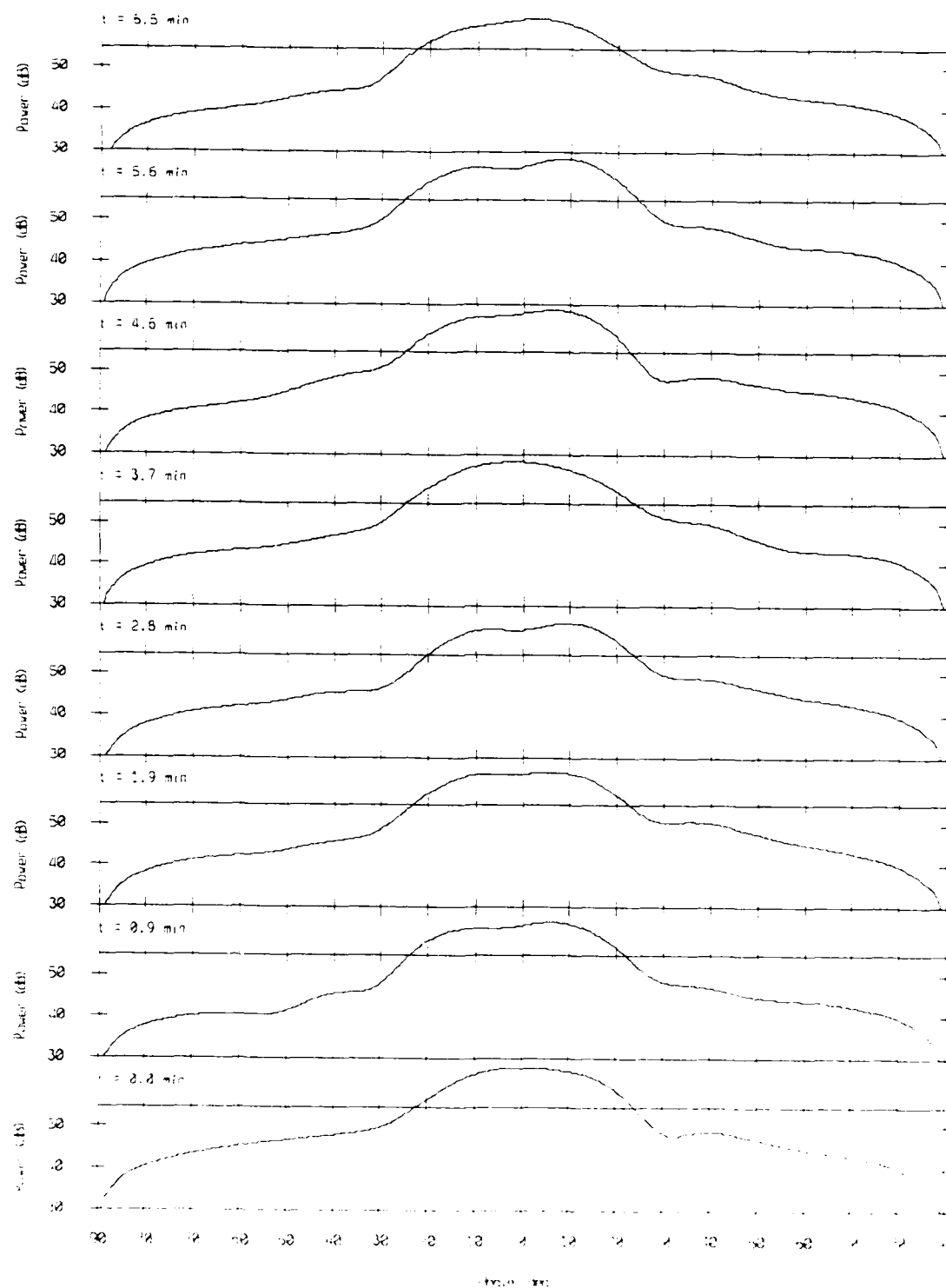
Array Response - 86180 Bin #4445

$f = 50$ Hz, ΔB window (sigma = 1.5)



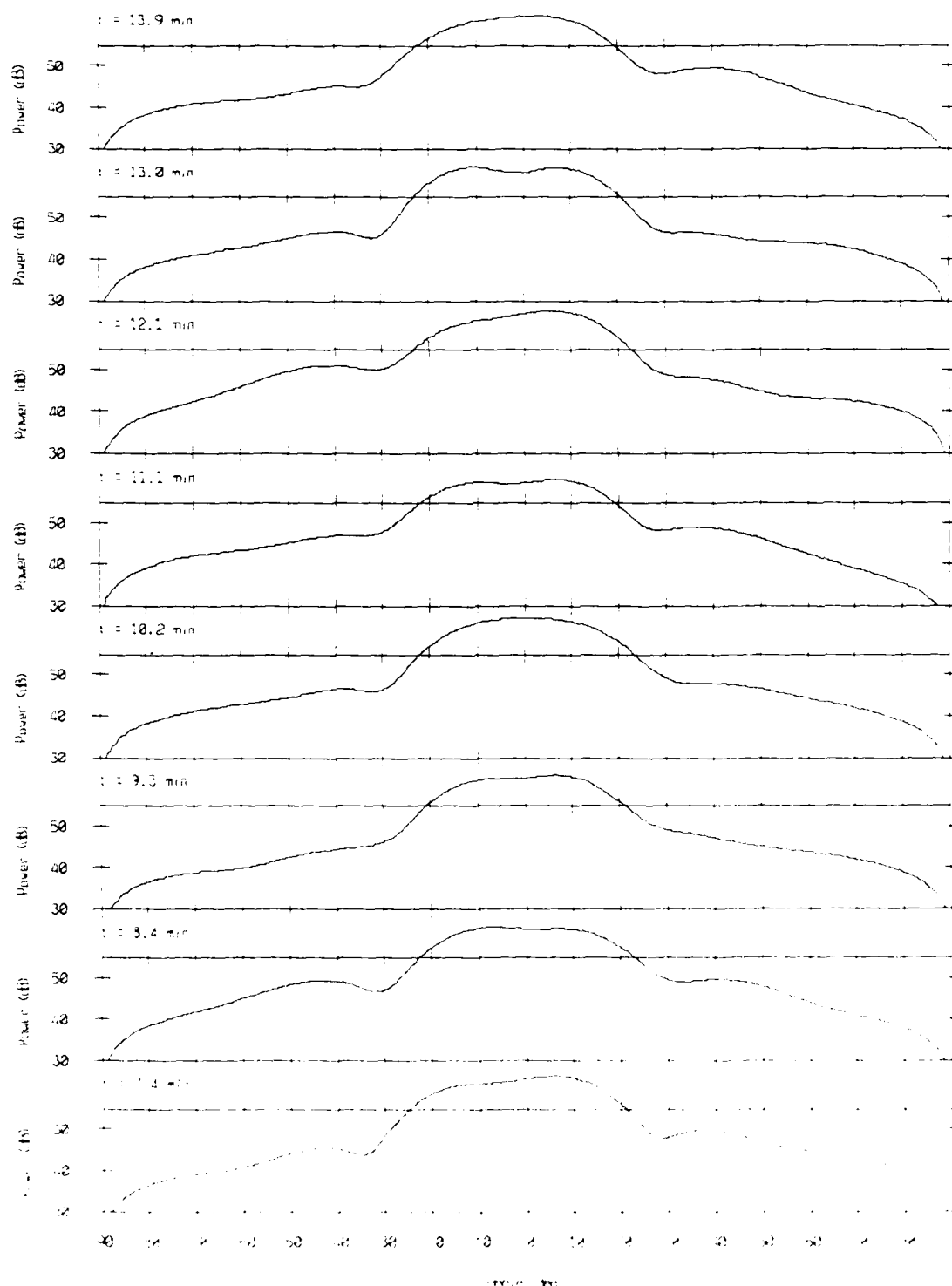
Power Response - 86180 Bin #4619

$f = 75$ Hz, ΔB window (alpha = 1.5)

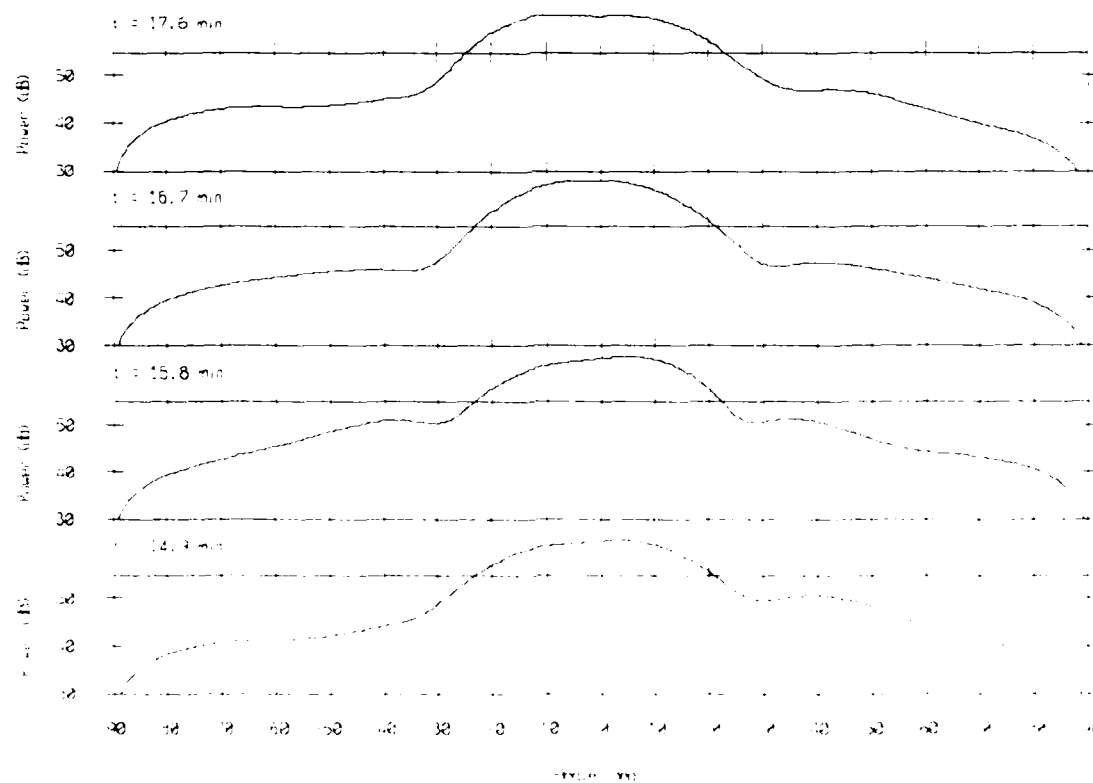


Array Response - 86180 3in #4619

$f = 75$ Hz, ΔB window (sigma) = 1.5)

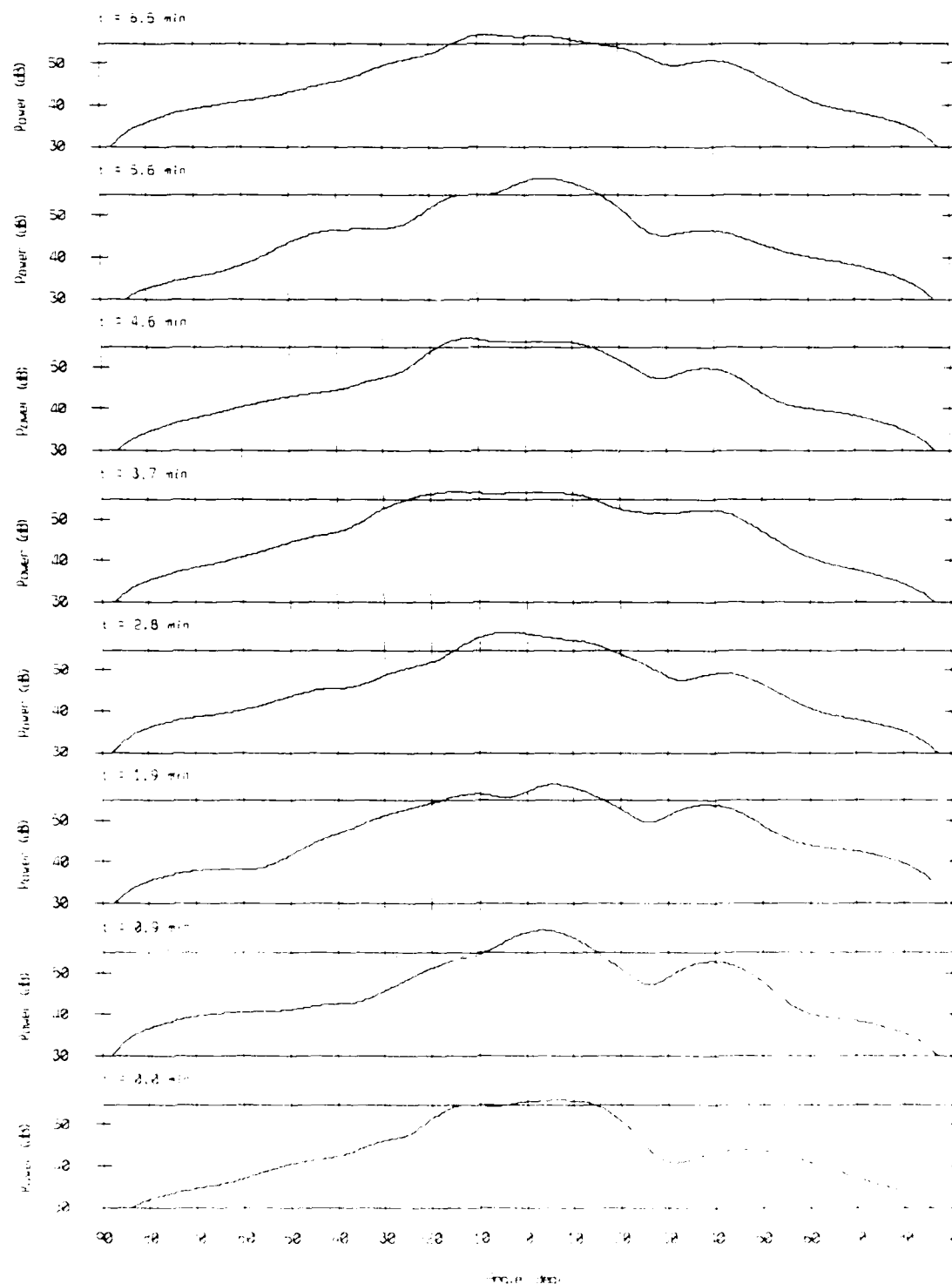


Array Response - 86180 Bin #4619
 $f = 75$ Hz, 48 window (band = 1.5)



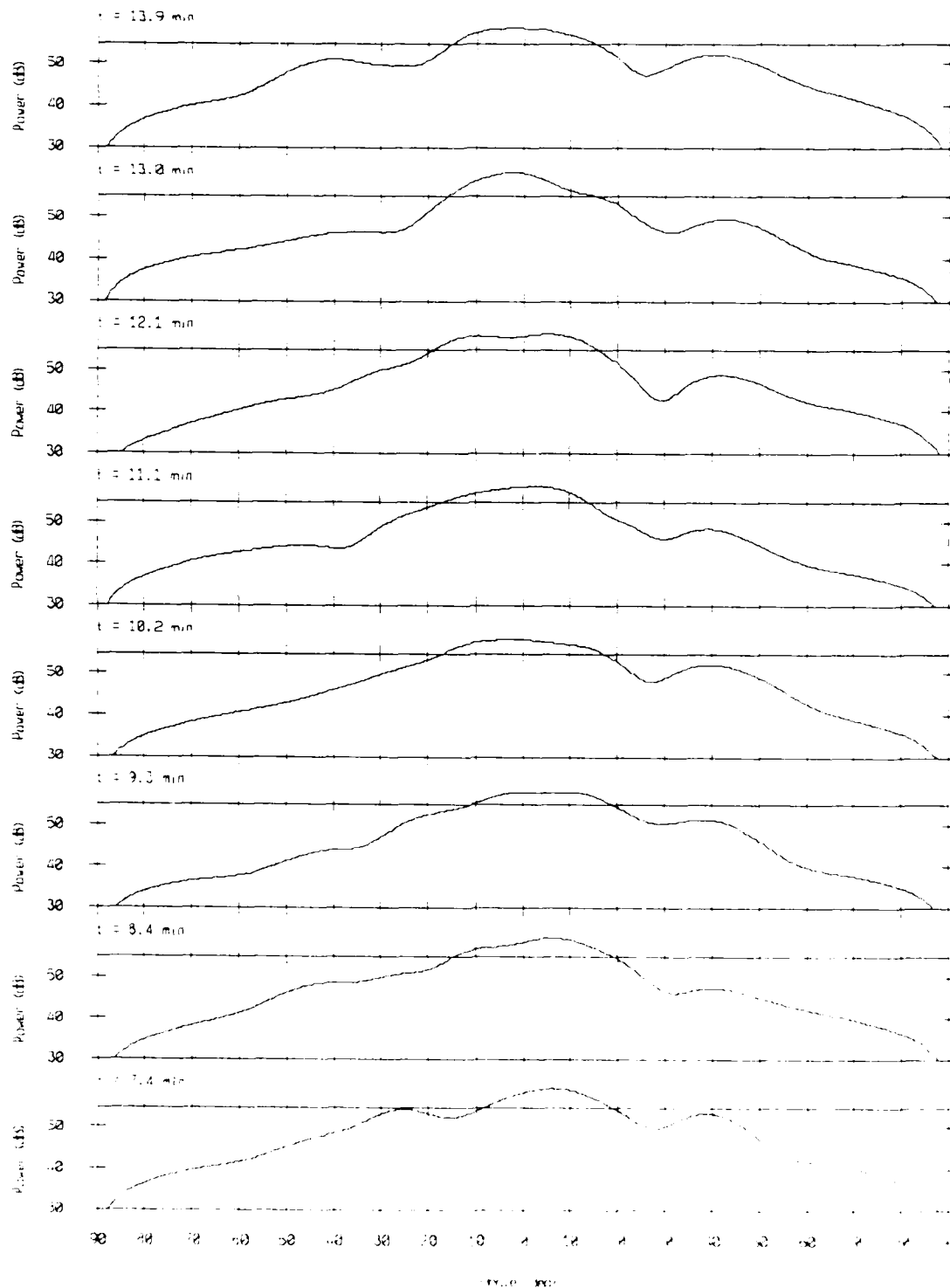
Power Response - 86180 3in #4793

$f = 120$ Hz, <5 window (alpha = 1.5)



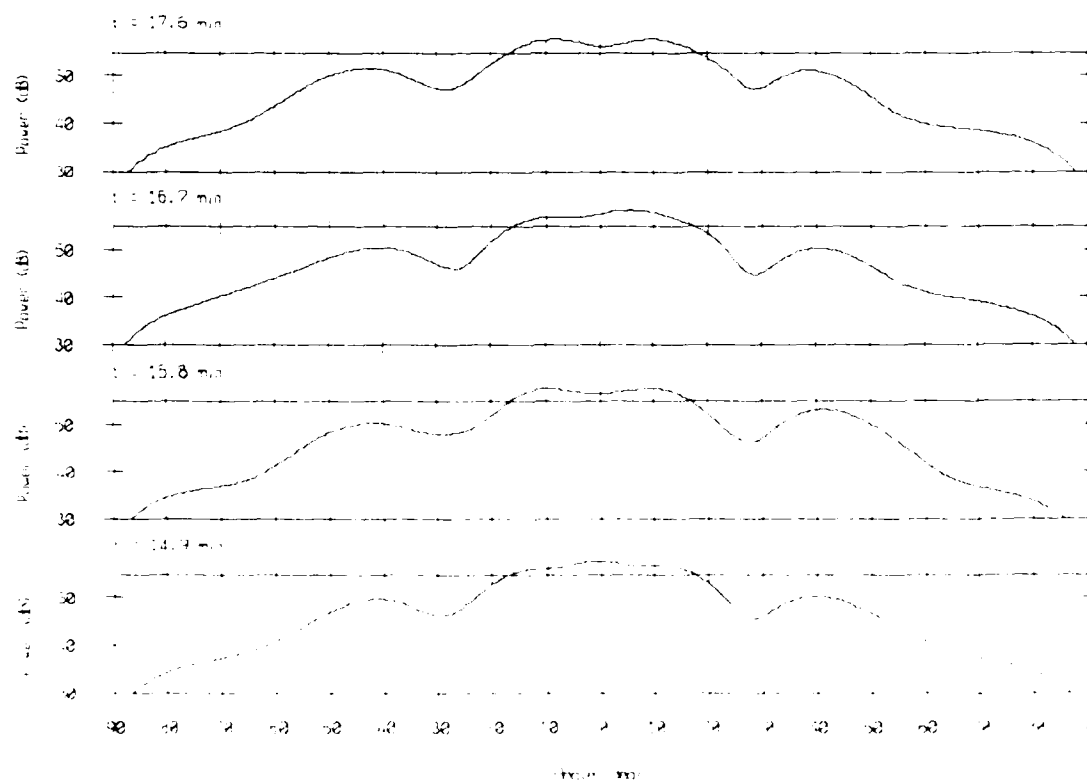
Array Response - 86180 Bin #4793

$\Delta = 120$ Hz, KB window (alpha = 1.5)



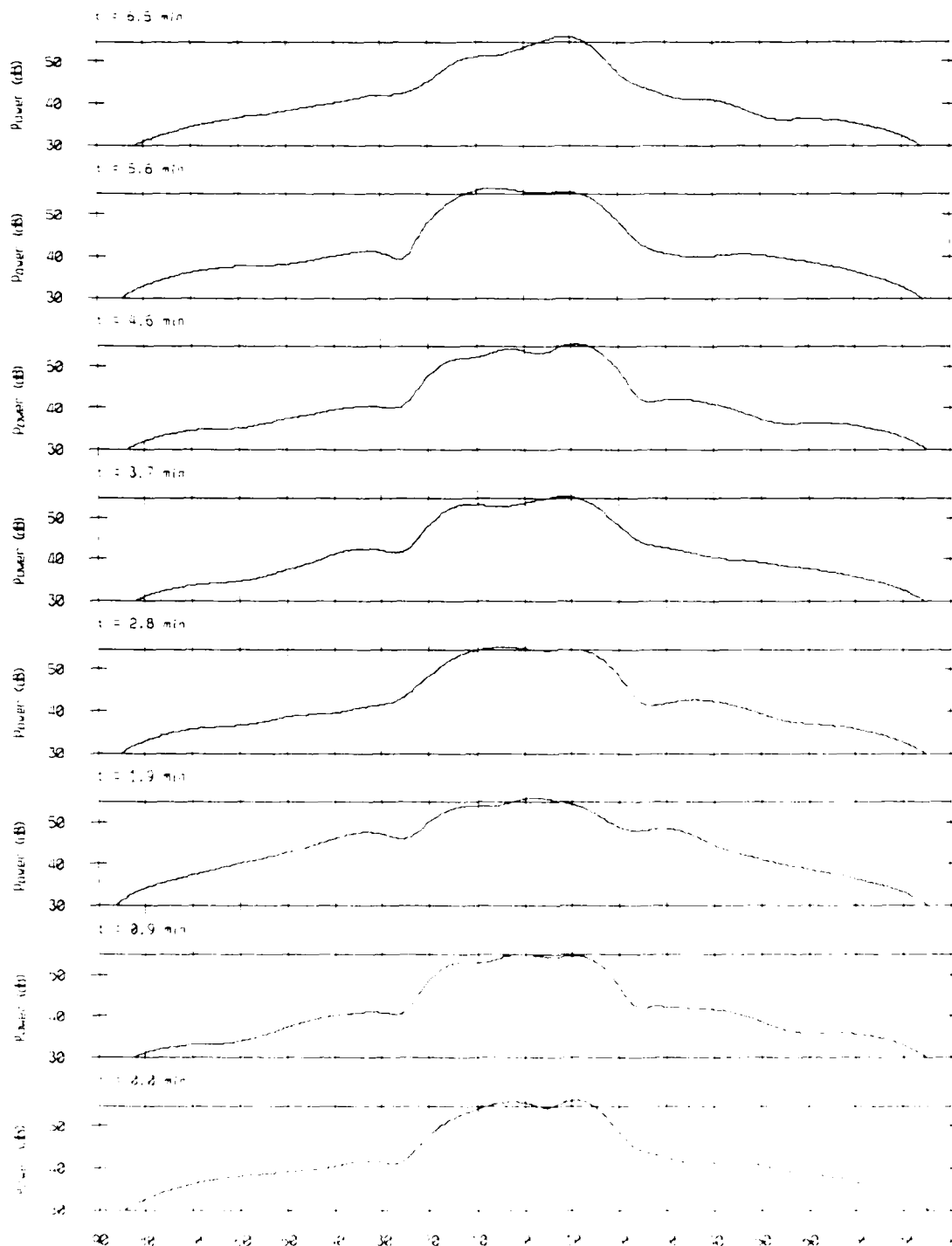
Array Response - 86180 3:~ #4793

$f = 120$ Hz, Δf window (band) = 1.5



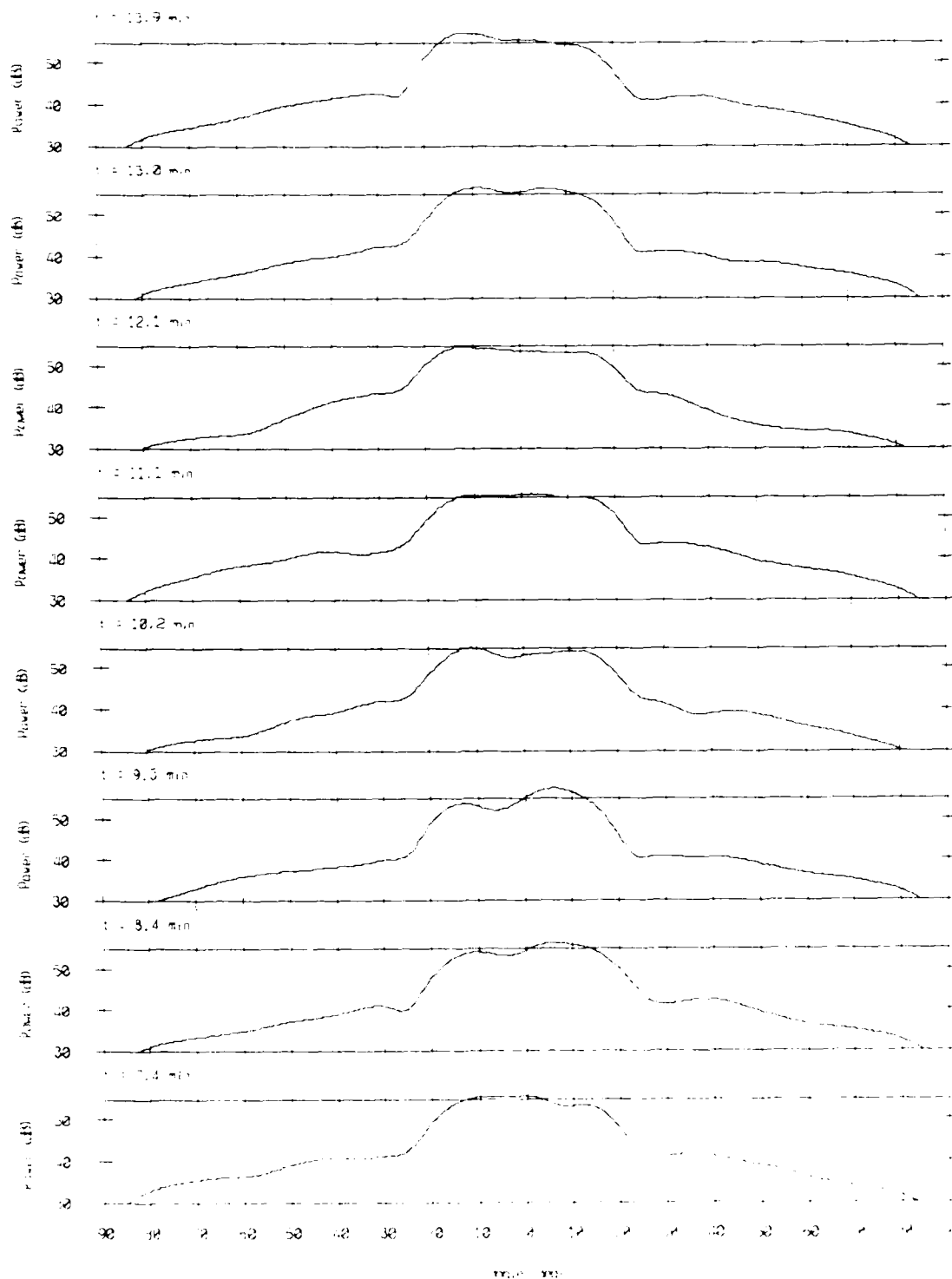
Ready Response - 86180 3in #4967

$f = 125$ Hz, Δf window (band) = 1.5



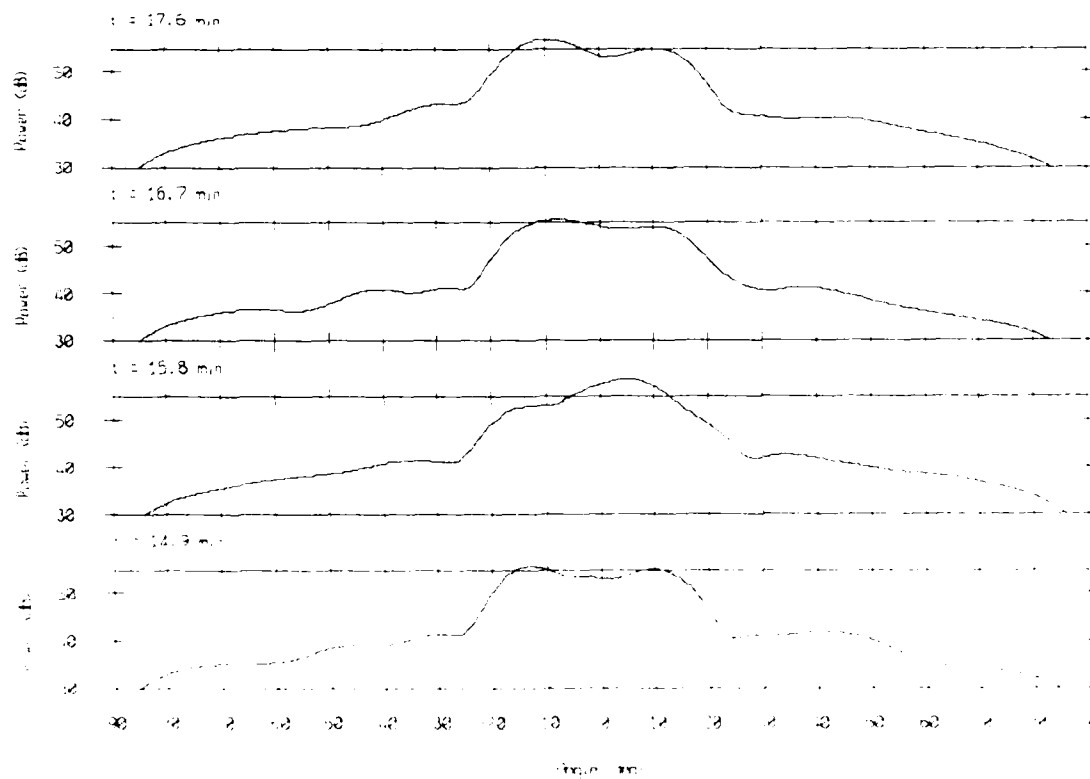
Grady Response - 85182 314 #4967

$f = 125$ Hz, 48 window, slope = 1.5



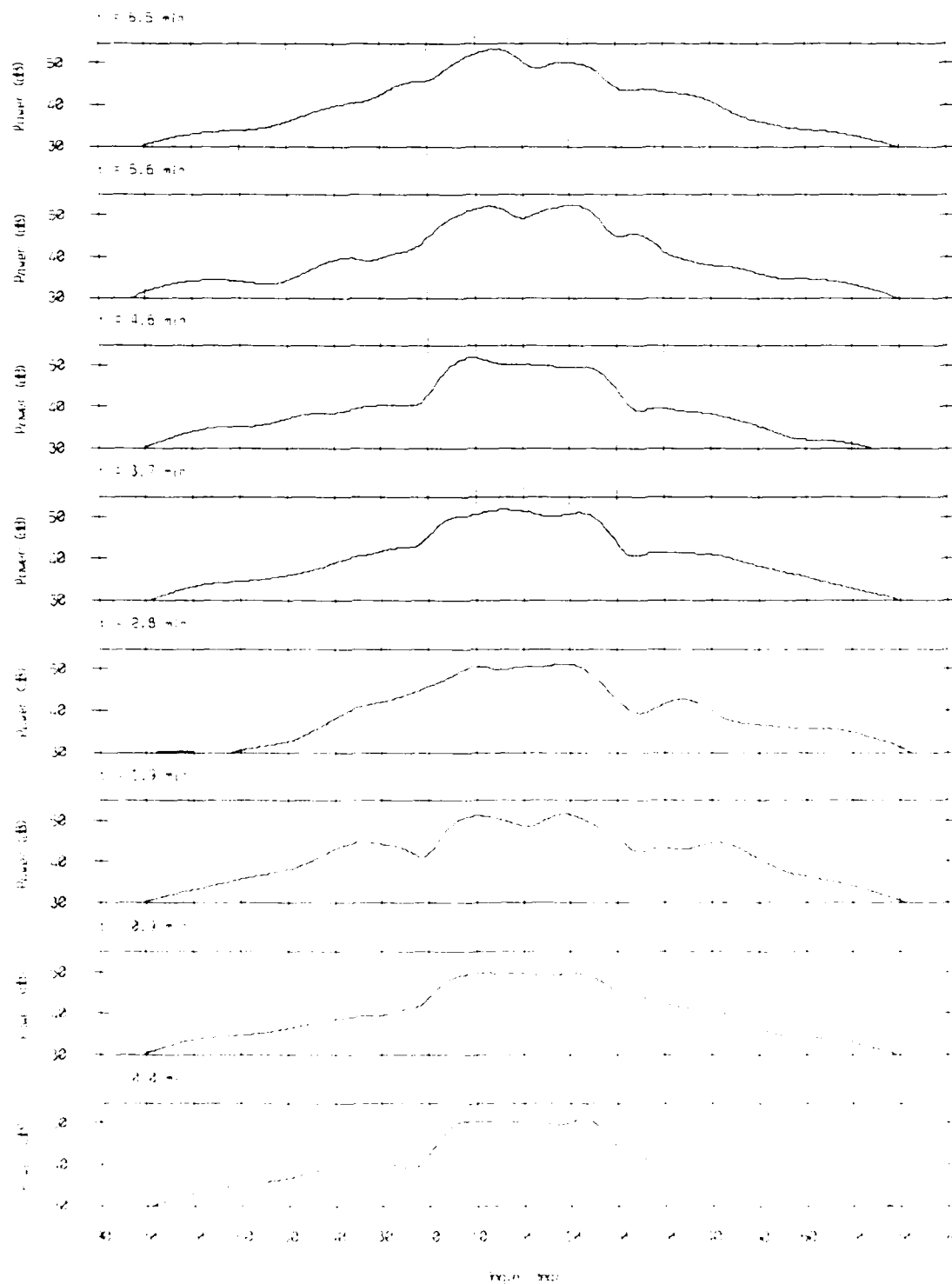
Acoustic Response - 86180 31r #4967

$f = 125$ Hz, Δf Window (alone) = 1.5



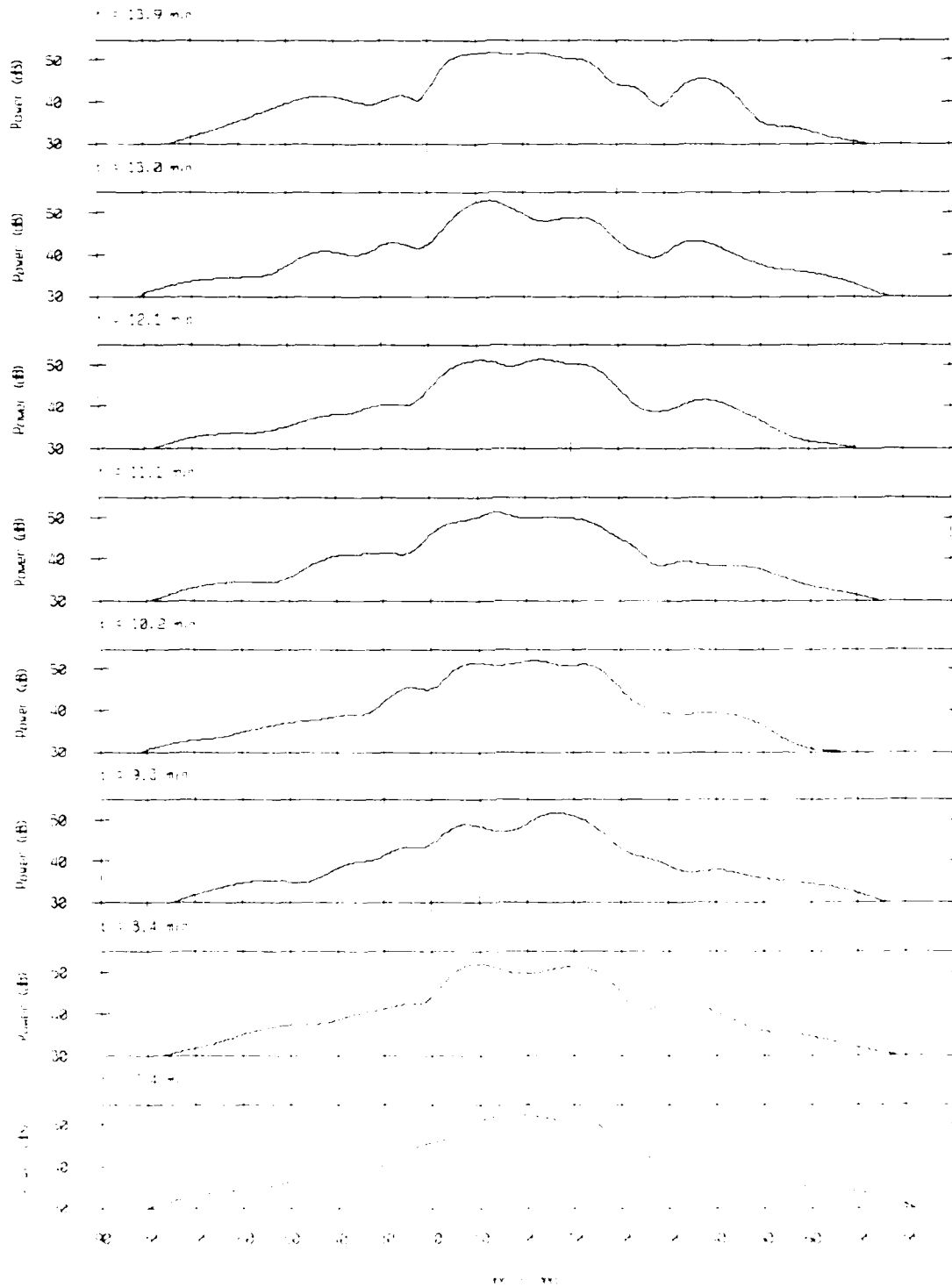
Band Response - 86180 Bin #5141

$f = 150$ Hz, Δf window (alpha = 1.5)



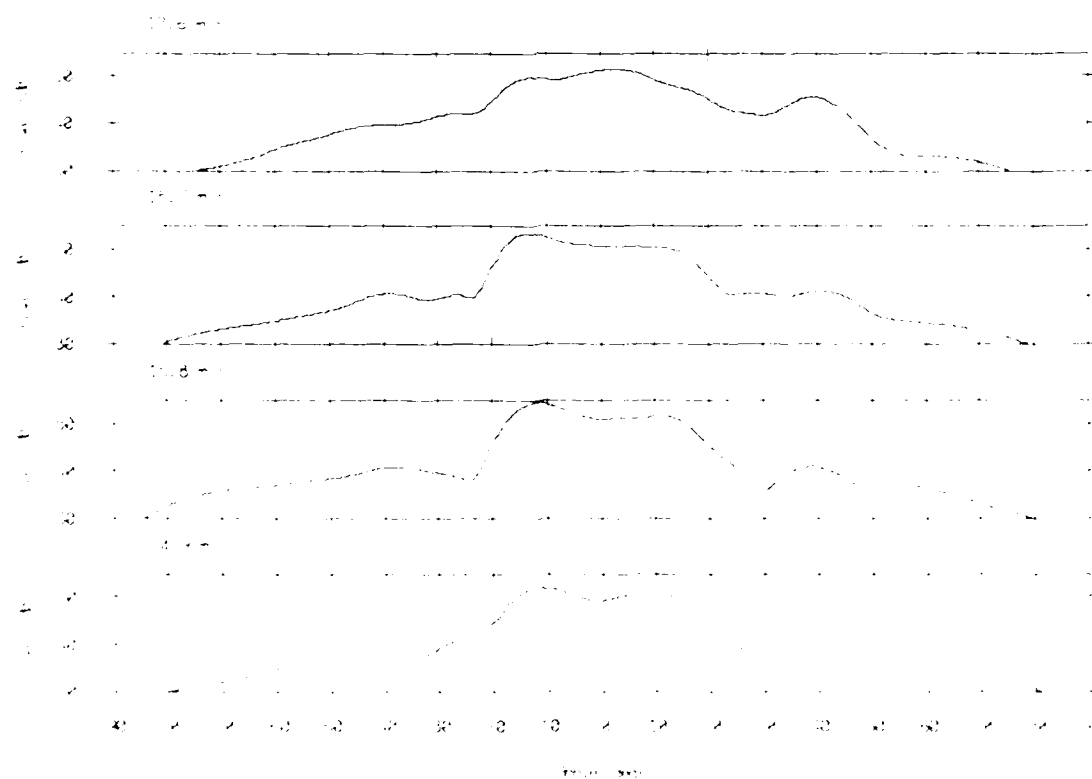
Brady Response - 86180 Bin #5141

$f = 152$ Hz, Δf window (alpha = 1.5)

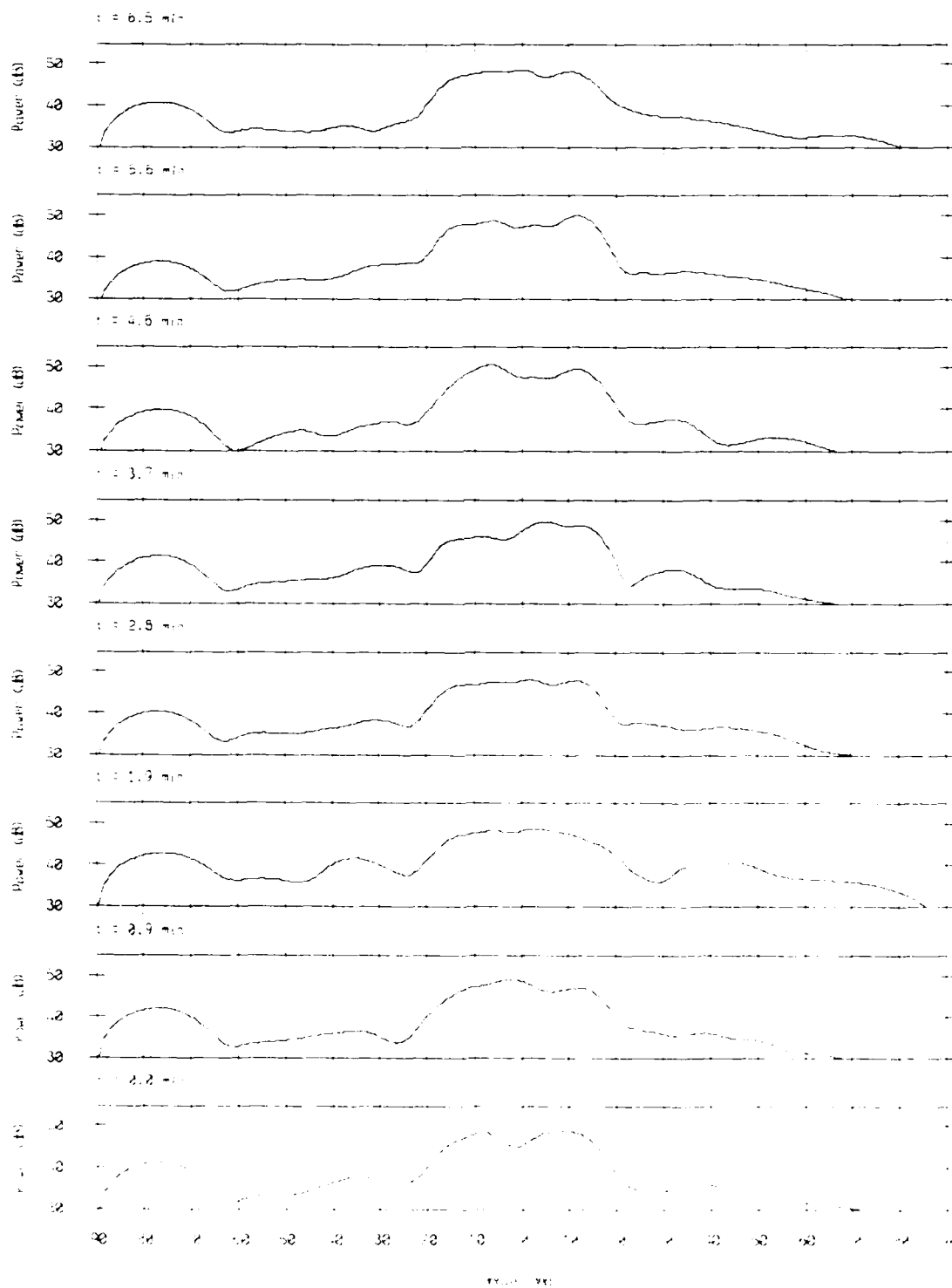


Energy Response - 86180 Bin #5141

$E = 150$ Hz, ΔB window (alpha = 1.5)

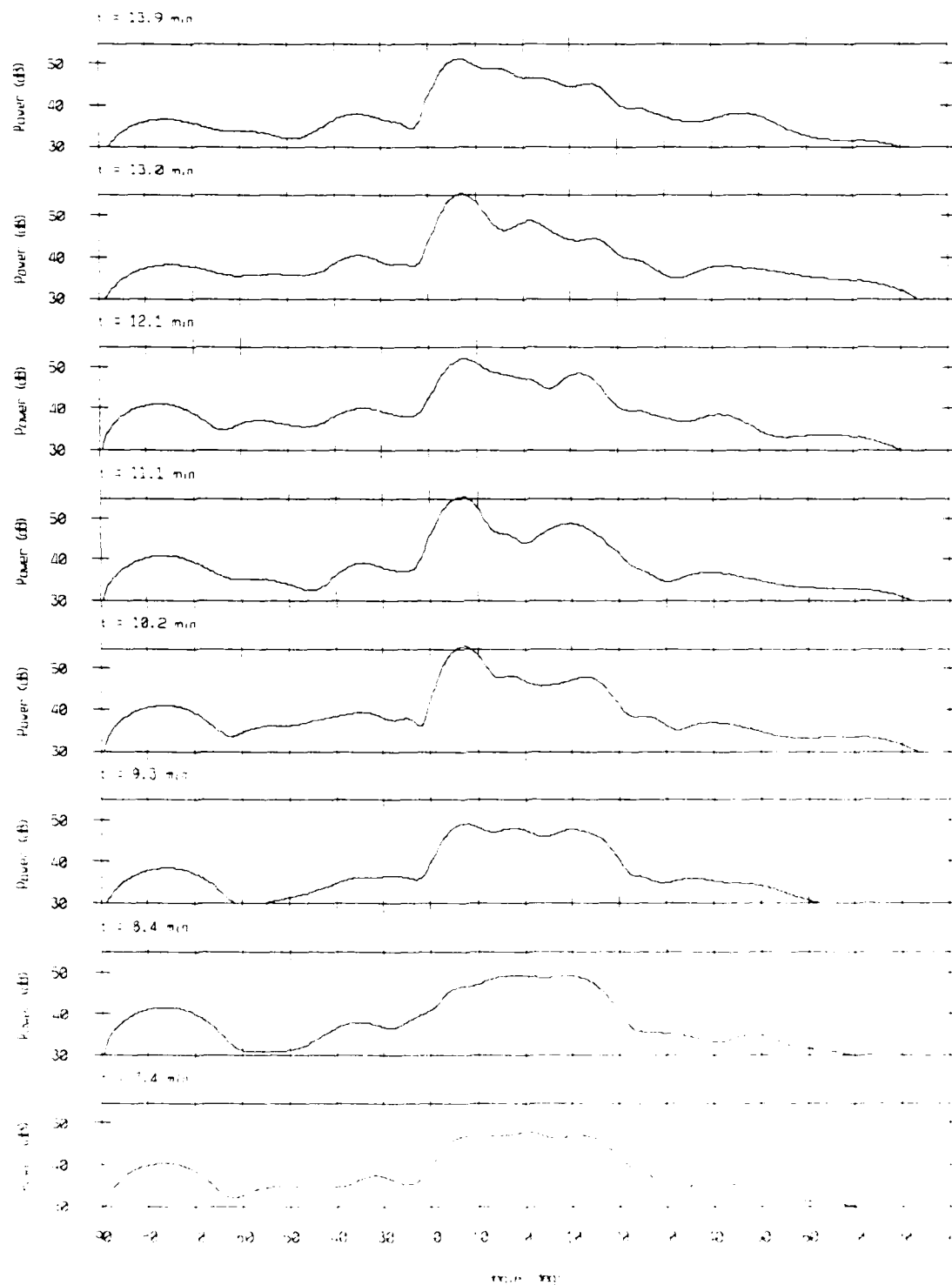


Array Response - 86180 Bin #5316
 $f = 175$ Hz, Δf window (band) = 1.5.



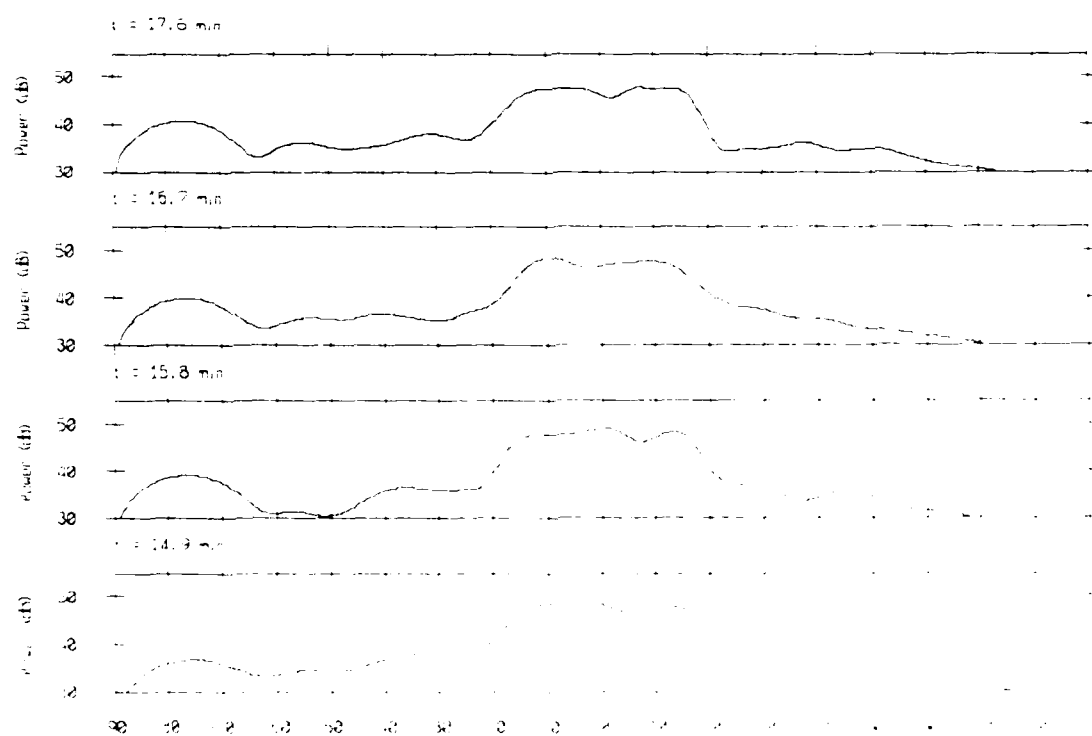
Array Response - 86180 Bin #5316

$f = 175$ Hz, ΔB window (alpha = 1.5)



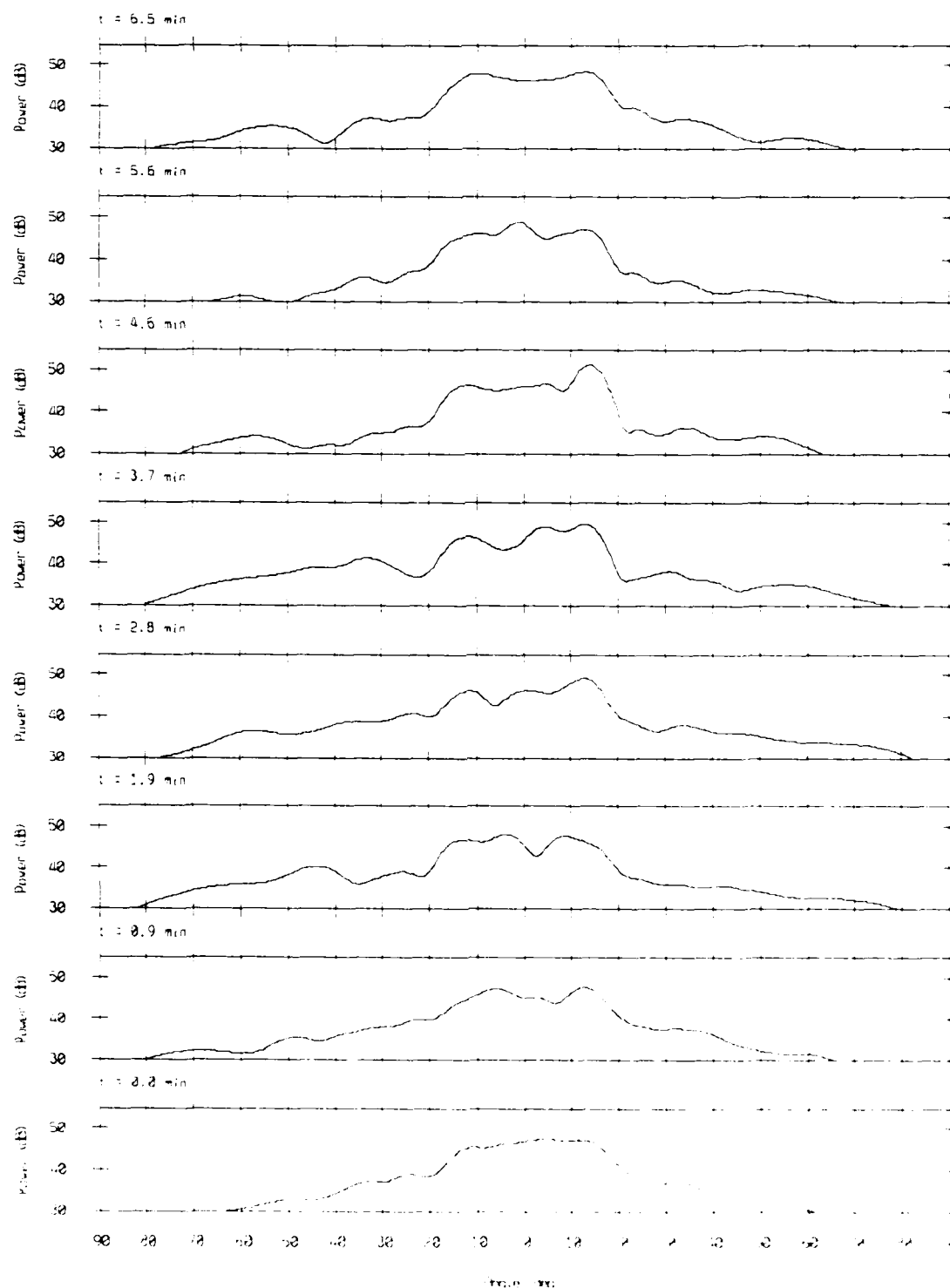
Array Response - 86180 Bin #5316

$f = 175$ Hz, KB window (alpha = 1.5)



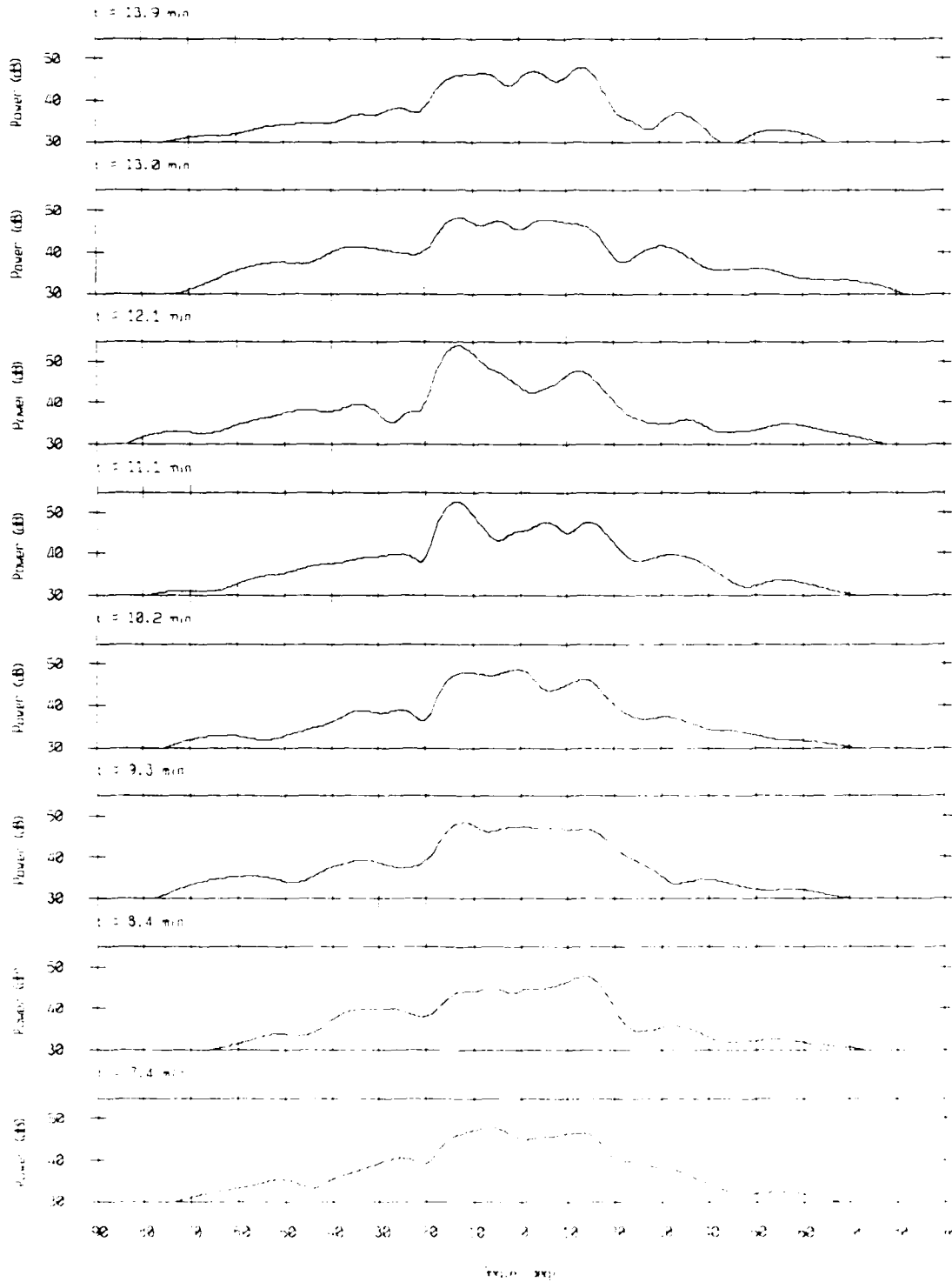
Array Response - 86180 31n #5490

$f = 200$ Hz, ΔB window (alpha = 1.5)

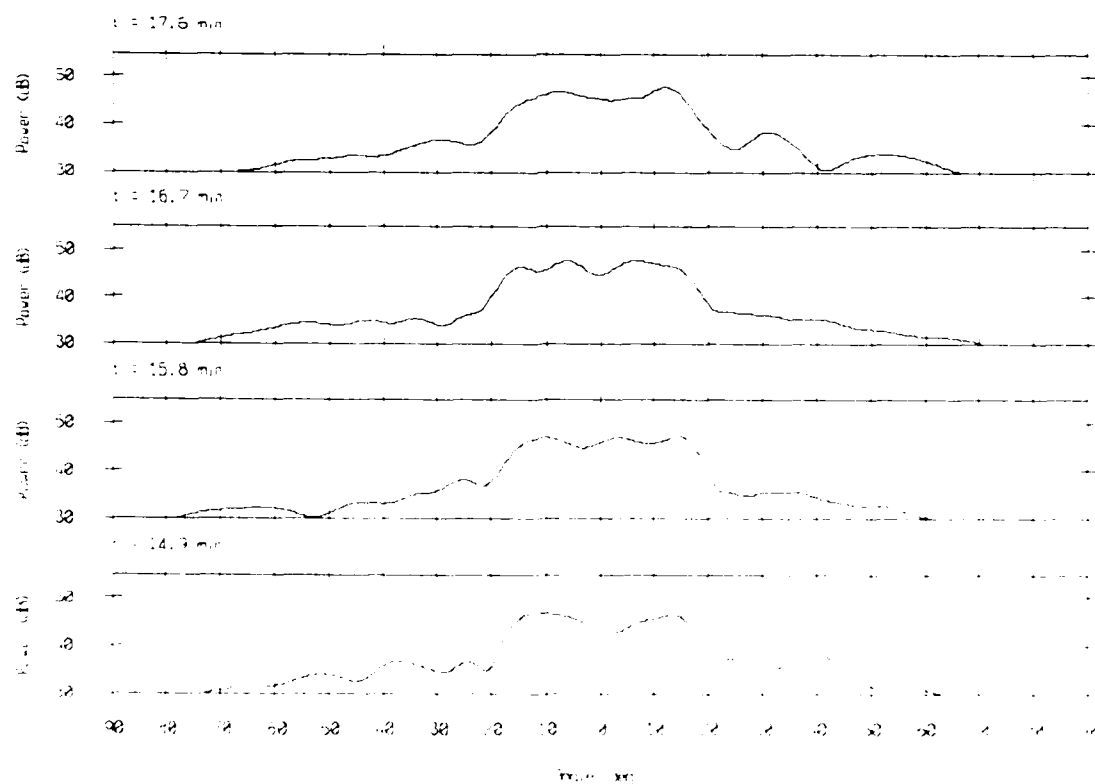


Array Response - 86130 Bin #5490

$f = 220$ Hz, Δf window (alpha = 1.5)

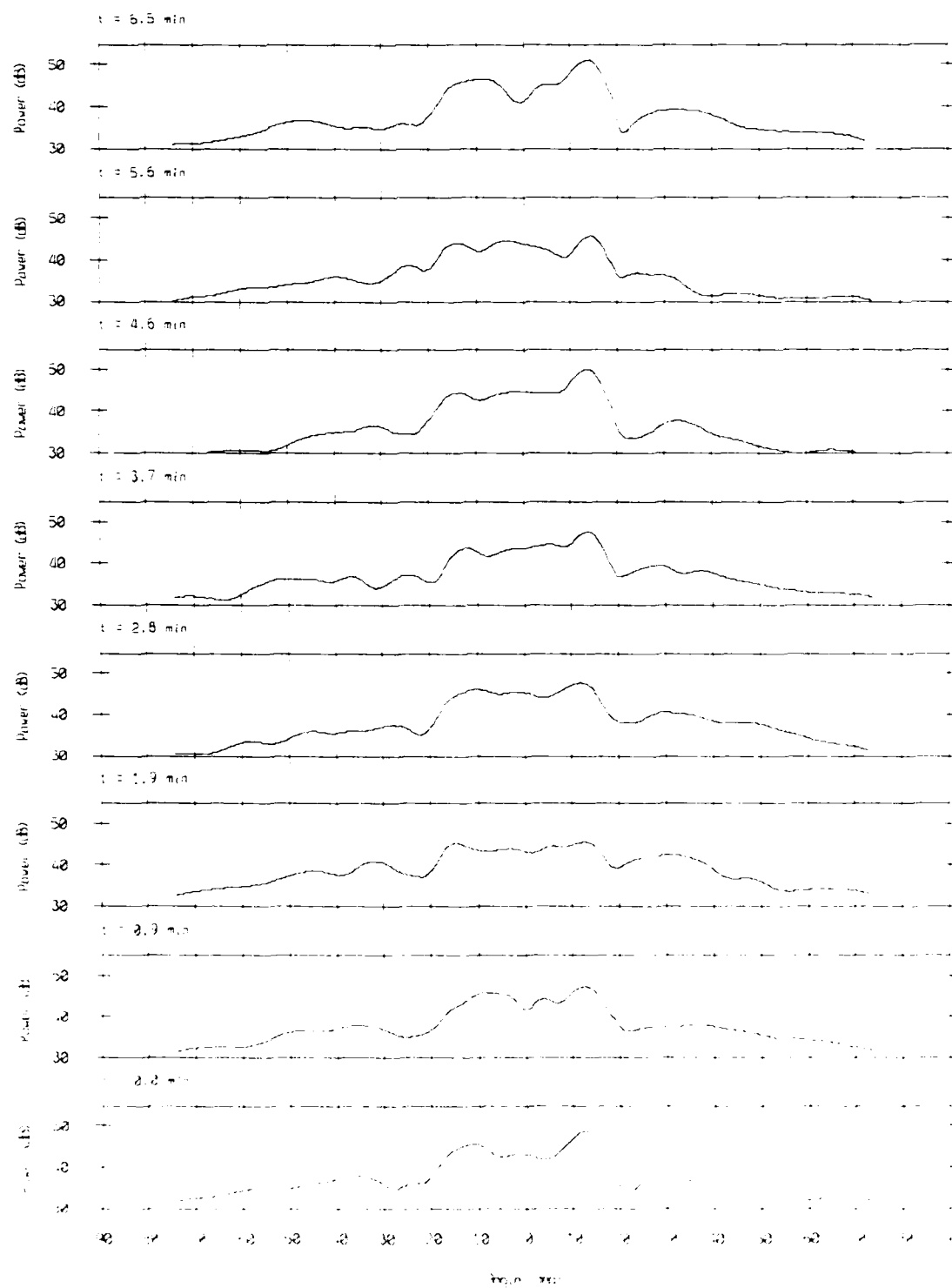


Array Response - 86180 Bin #5490
 $\beta = 200 - z$, $\langle B \rangle$ window (alpha = 1.5)



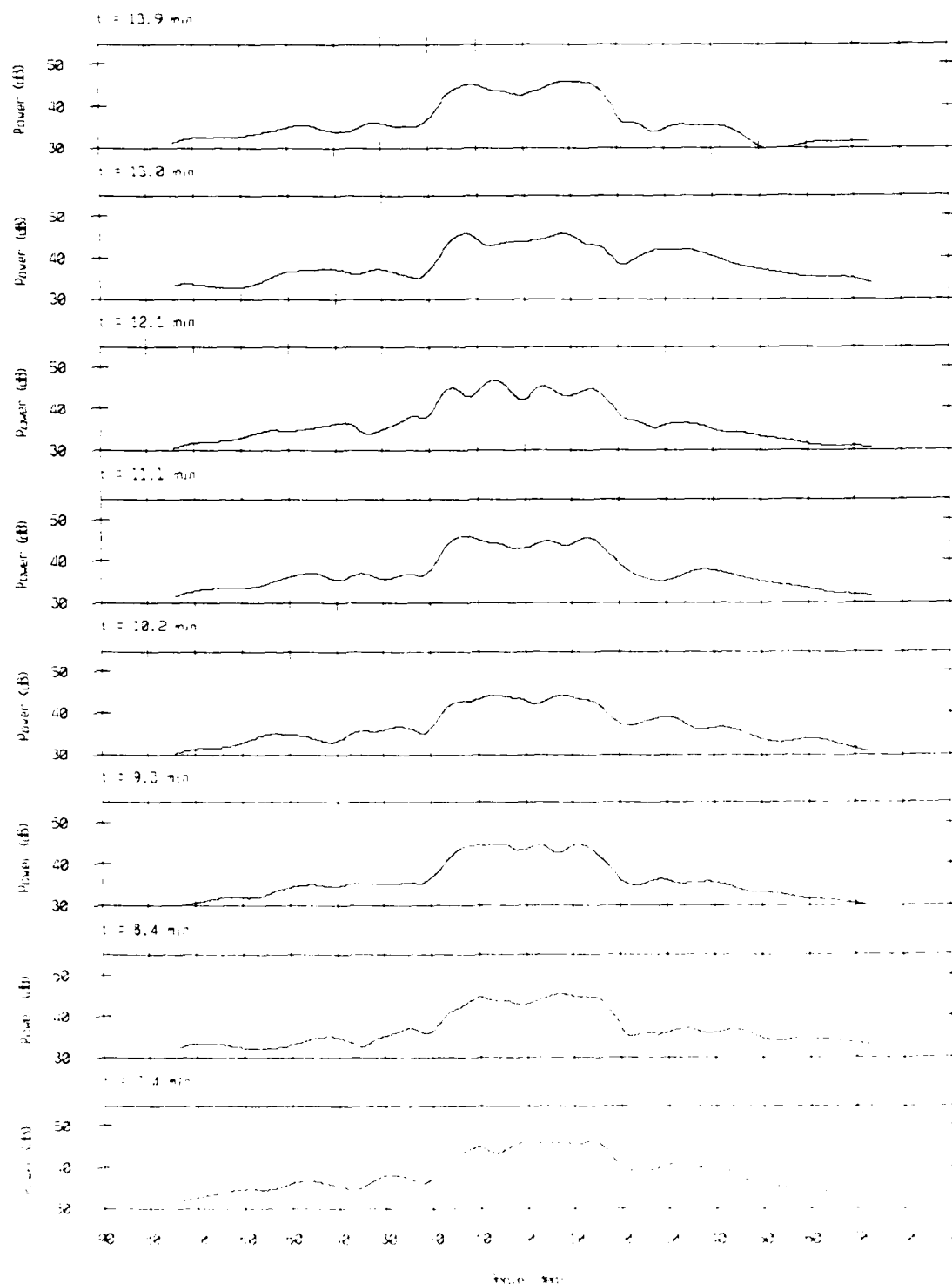
Array Response - 86180 3in #5664

$f = 225$ Hz, KB window (alpha = 1.5)



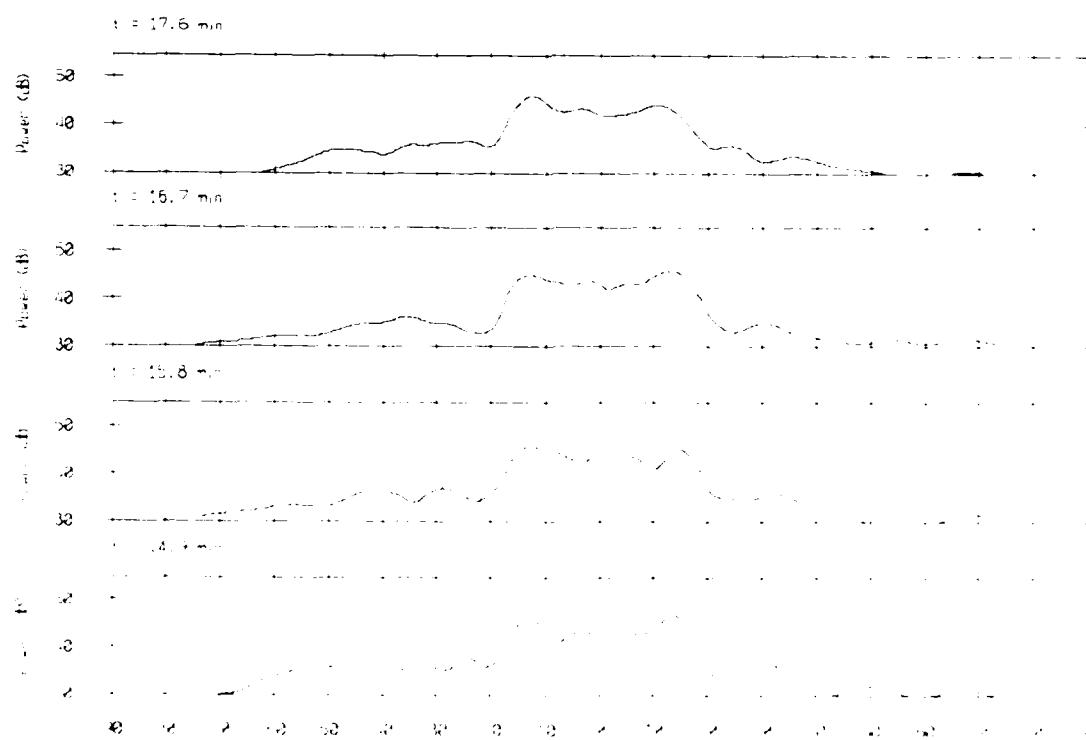
Array Response - 86180 Bin #5664

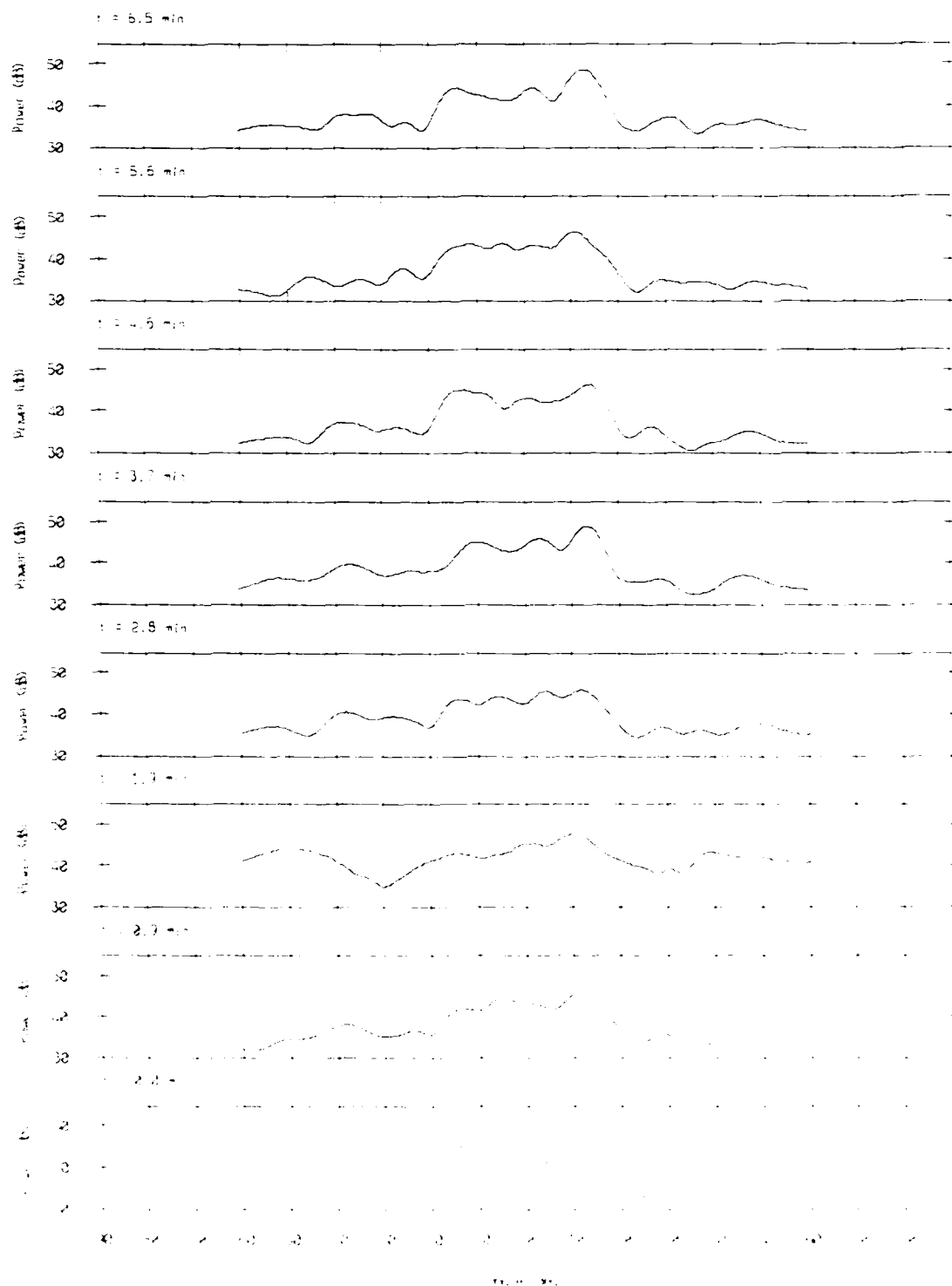
$f = 225$ Hz, <B window (alpha = 1.5)



Array Response - 86180 Bin #5664

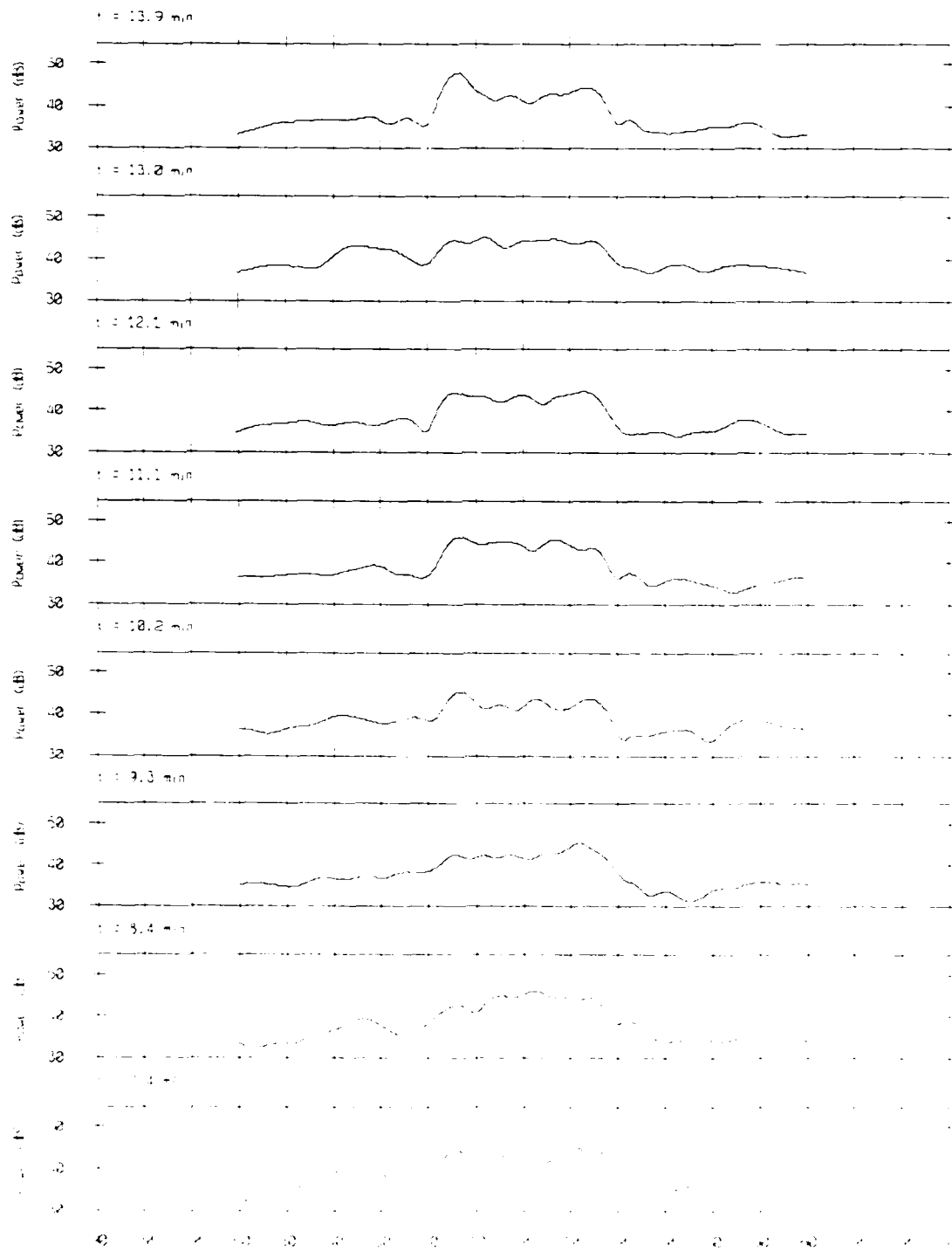
$f = 225$ Hz, KB window (sigma = 1.5)



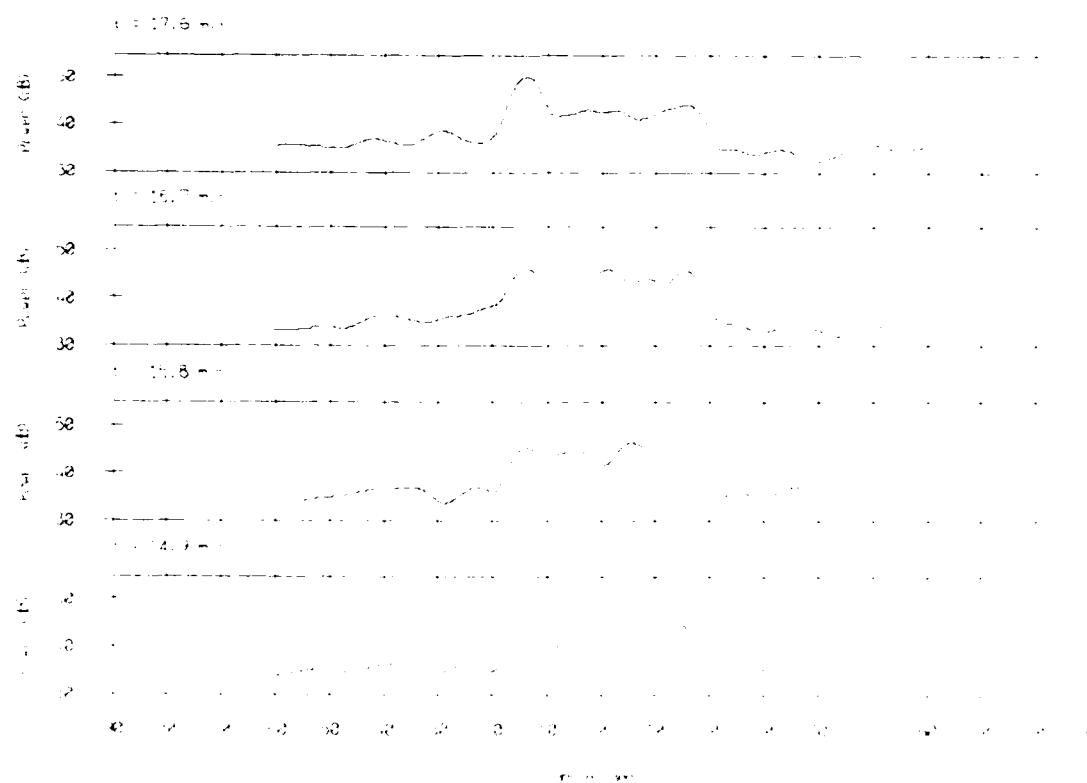
$\Delta f = 250 \text{ Hz}$, ΔB window (area) = 1.5,

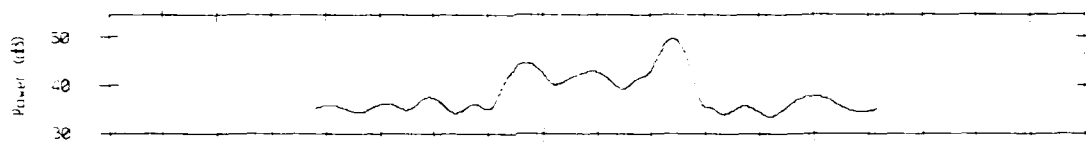
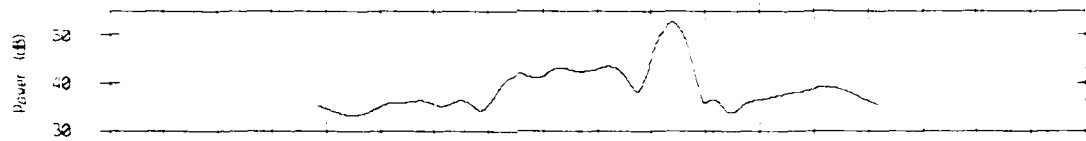
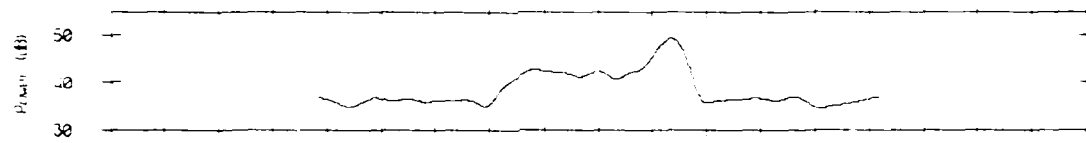
Array Response - 86180 Bin #5832

$f = 252$ Hz, <B window (alpha = 1.5)

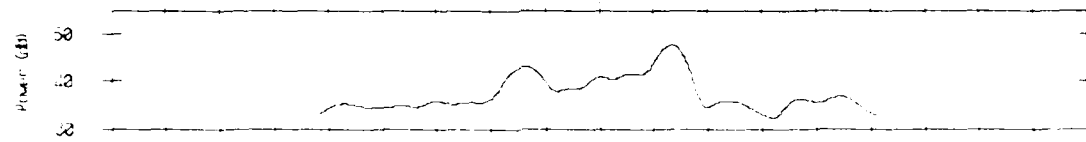
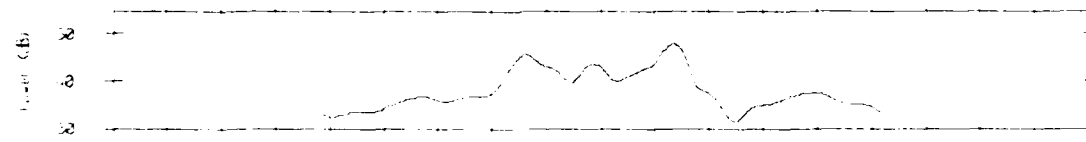


Array Response - 86182 31r #6532
 f = 252 Hz, <3 window (alone) = 1.6



$$z = 275 - z, \text{ } \Delta 3 \text{ window (along} = 1.5)$$
 $t = 5.5 \text{ min}$  $t = 5.6 \text{ min}$ 
$$\tau = 4.5 \text{ } \mu\text{s}$$


• : 3.7 תח

 $\gamma = 2.8$ mm

123



2.9 - 1



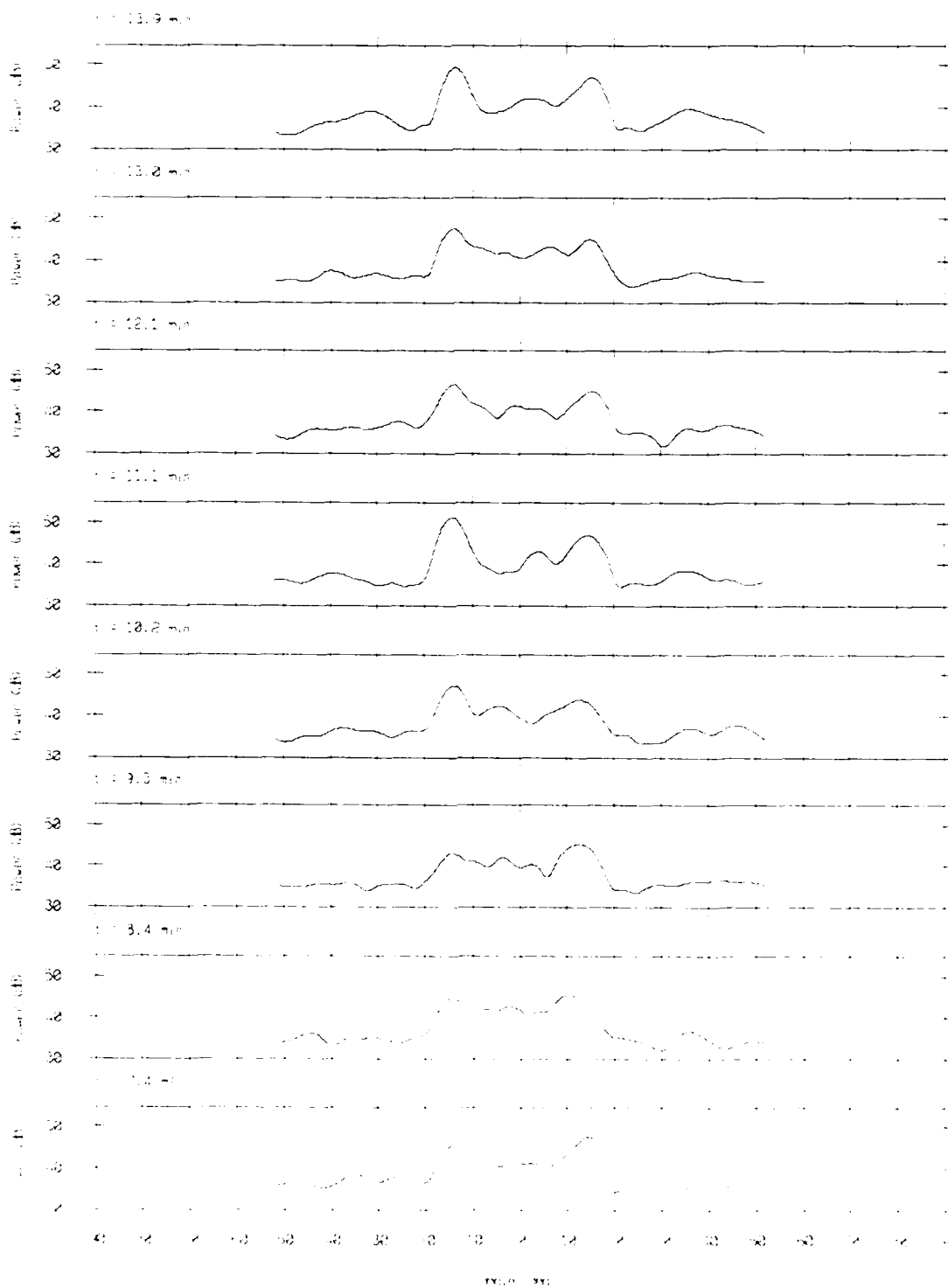
222

3

84 10 88

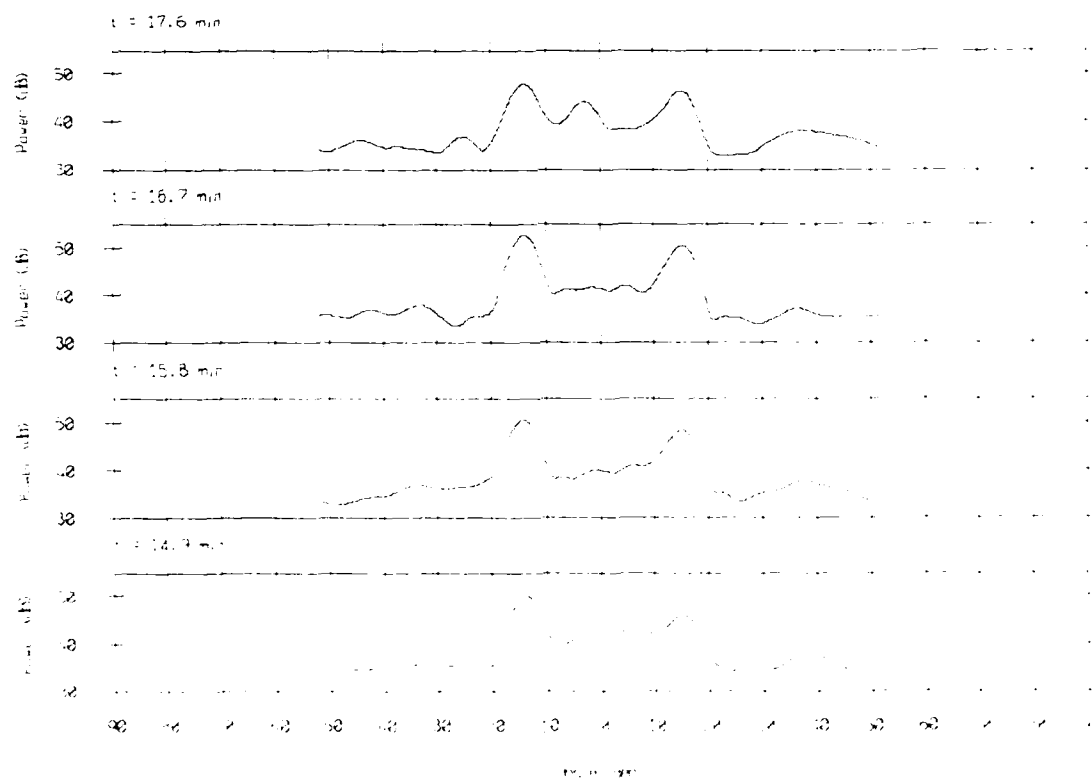
Array Response - 86180 Bin #6012

$\lambda = 275$ m, KB window (alpha = 1.5)

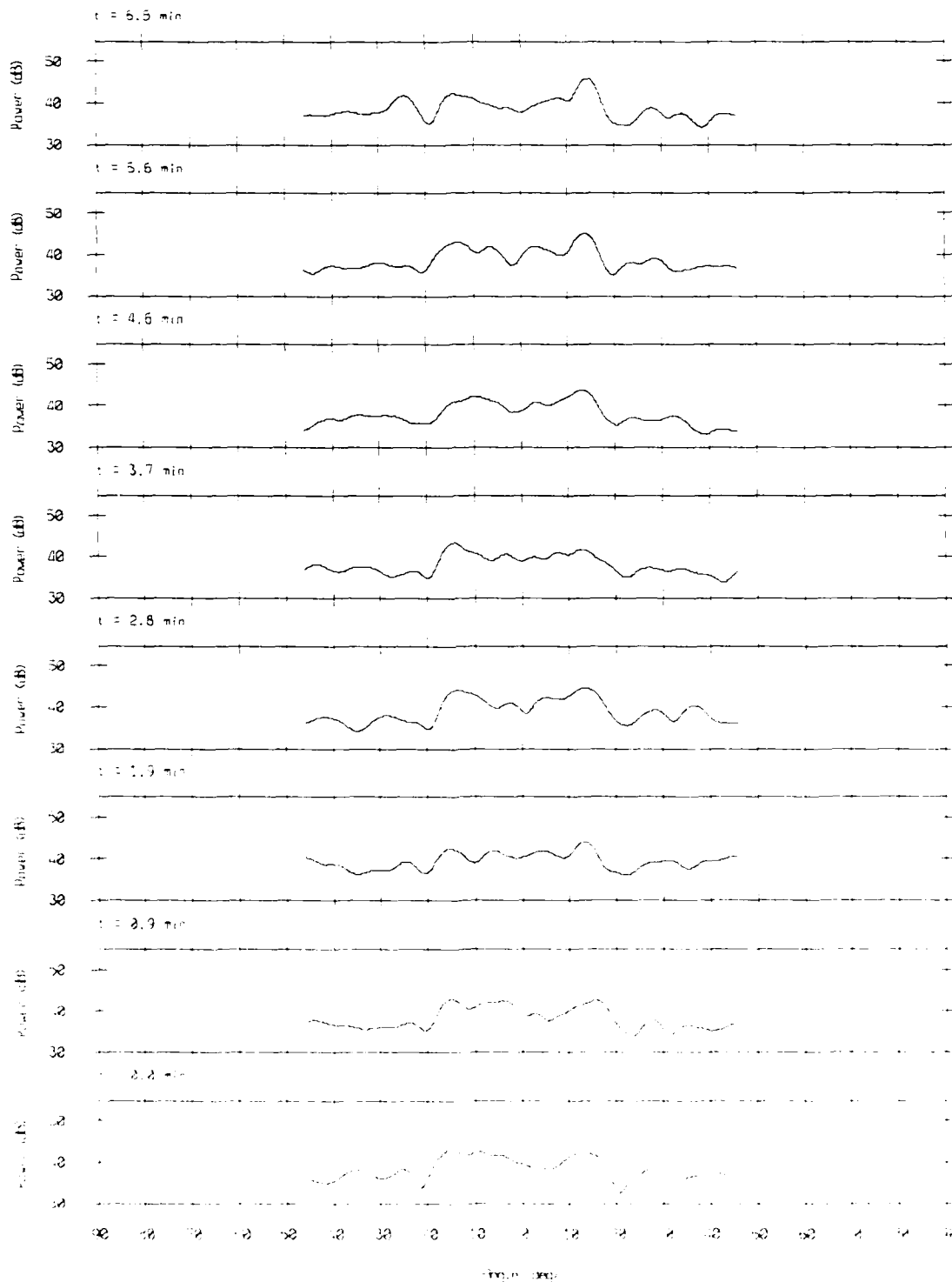


Array Response - 86180 Bin #6012

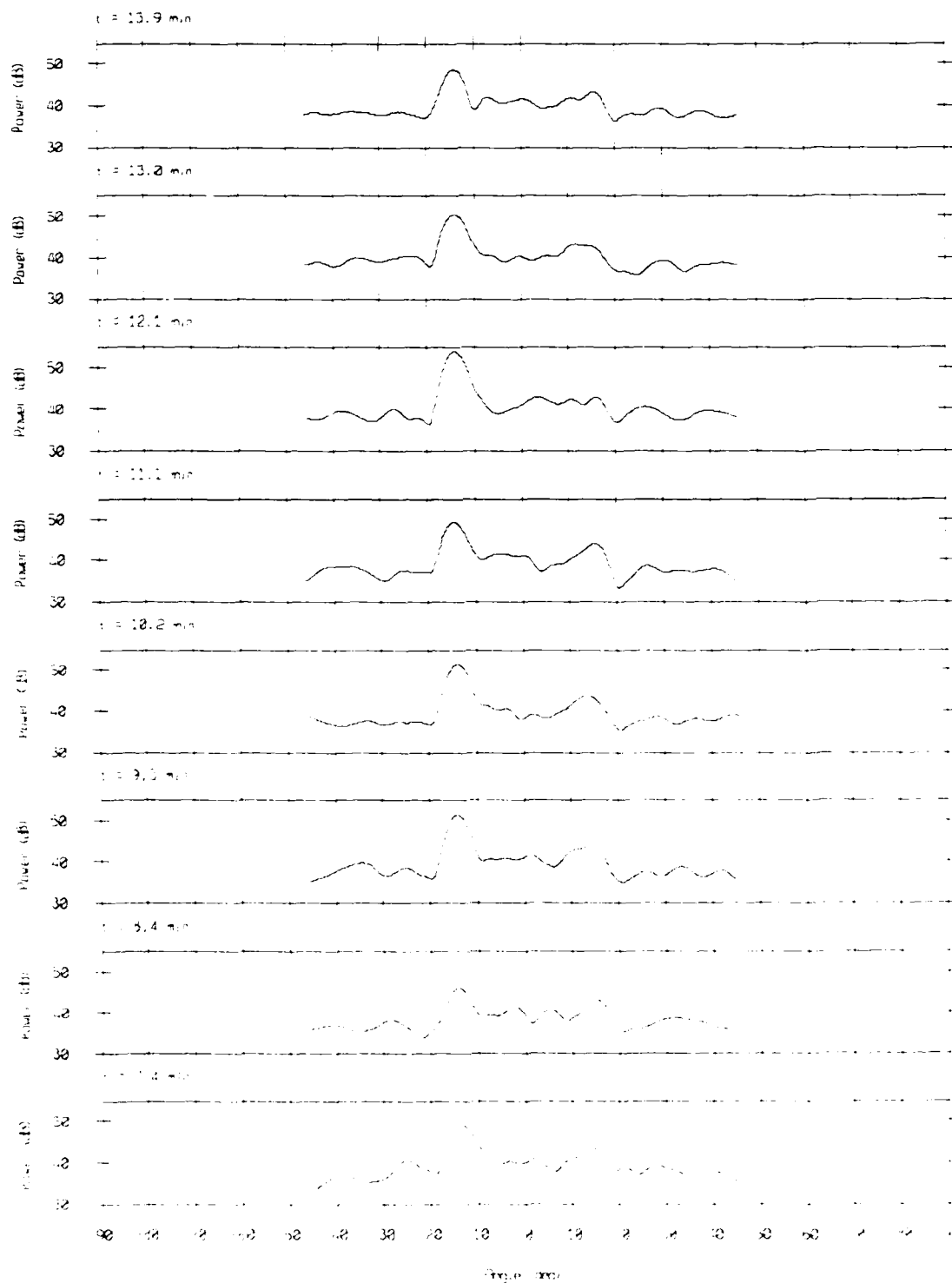
$f = 275$ Hz, KB window (alpha = 1.5)



Array Response - 86180 Bin #6186
 $f = 300$ Hz, KB window (alpha = 1.5)

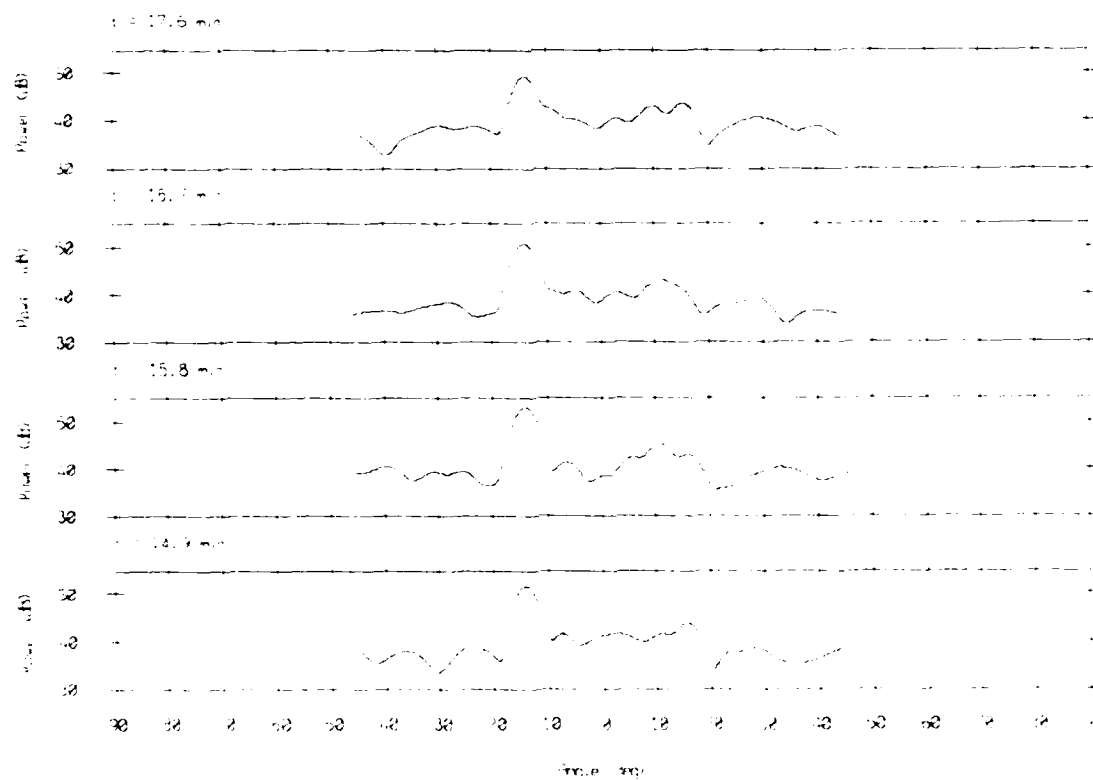


Array Response - 86180 Bin #6186
 $\Delta = 300$ Hz, KB window (alpha = 1.5)



Array Response - 86180 Bin #6186

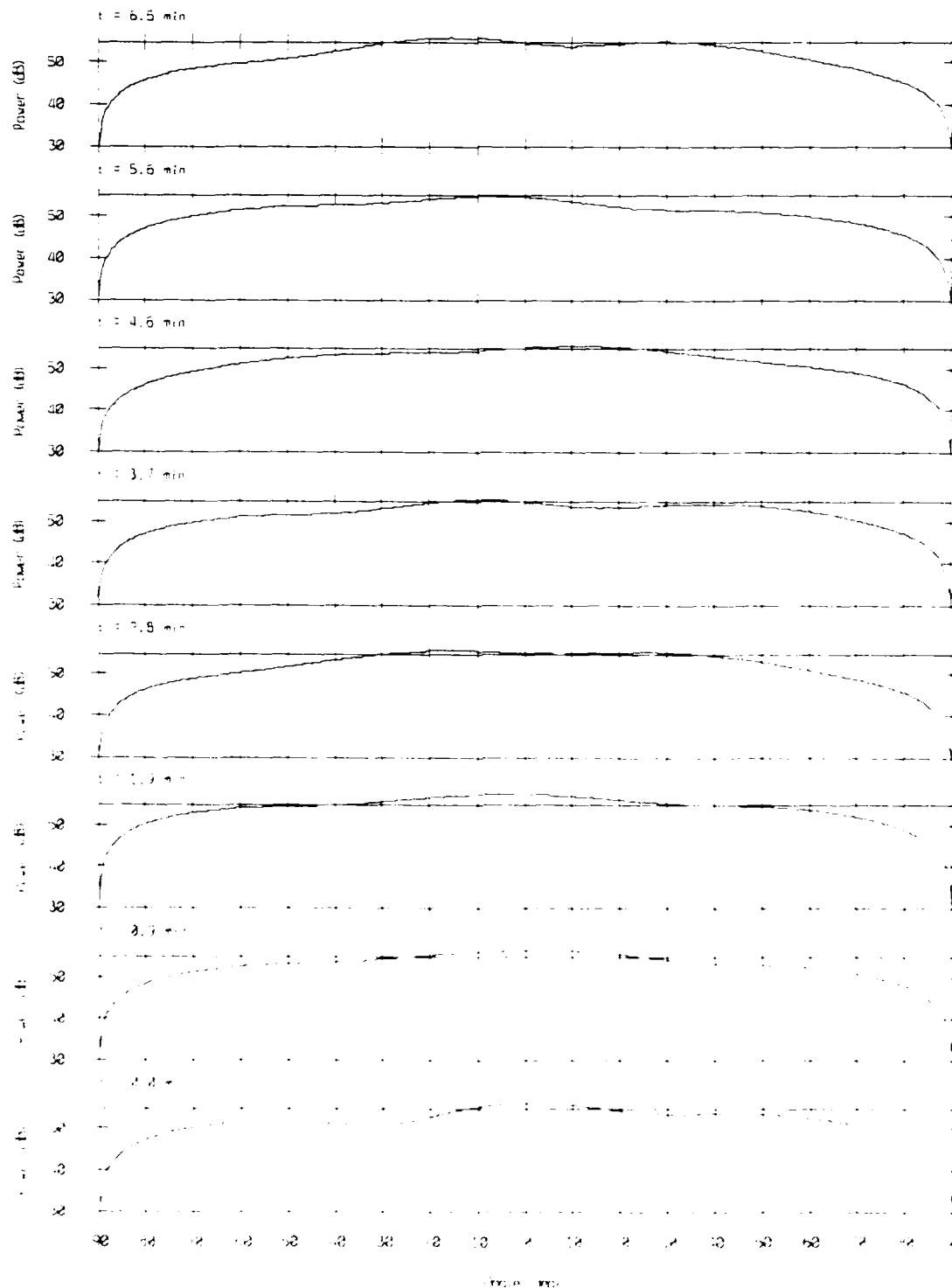
$f = 300$ Hz, KB window (alpha = 1.5)



VII. Array Response: Panels, Rect Window.

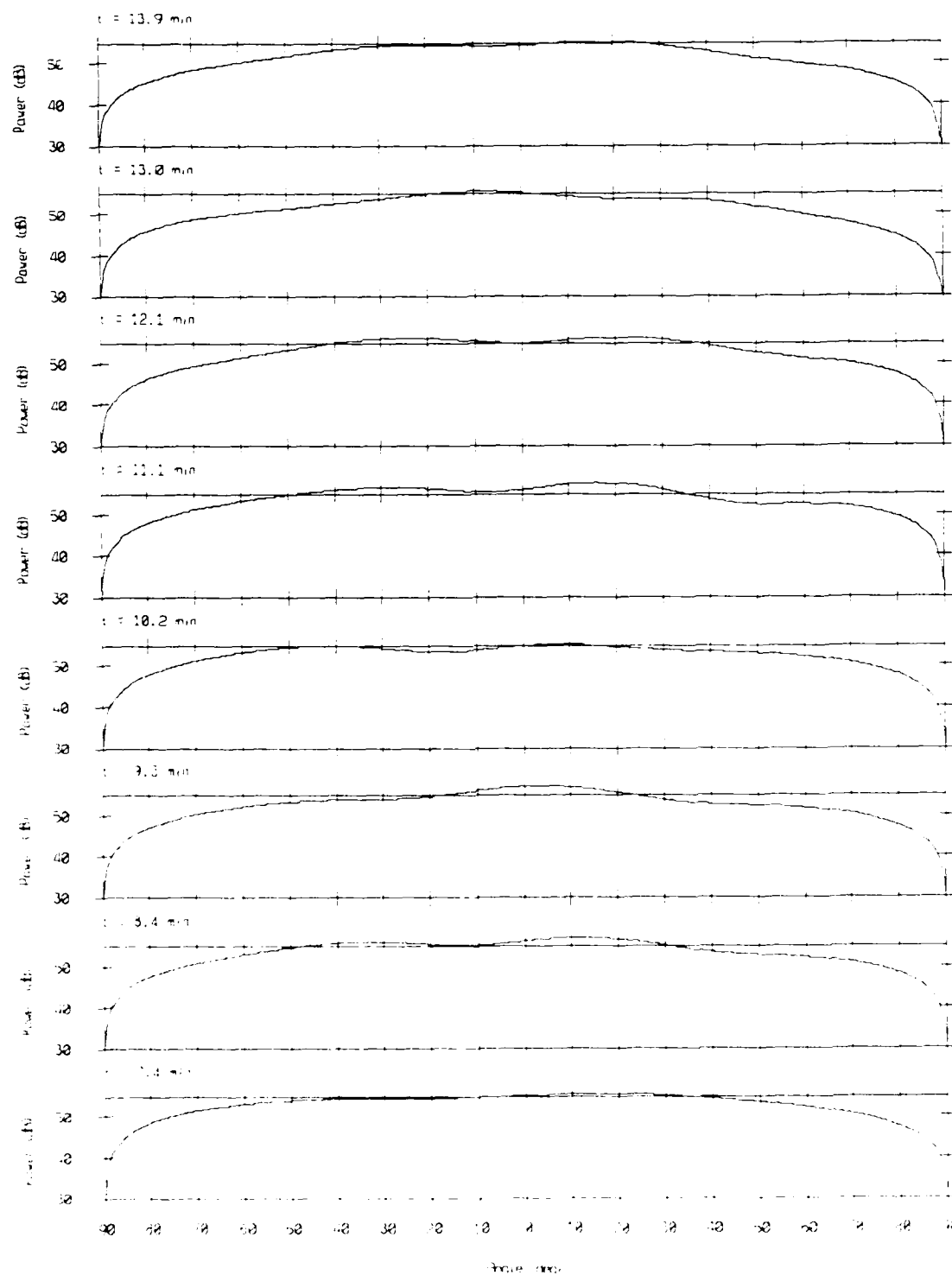
Array Response - 86180 Bin #4271

$f = 25$ Hz, rect window



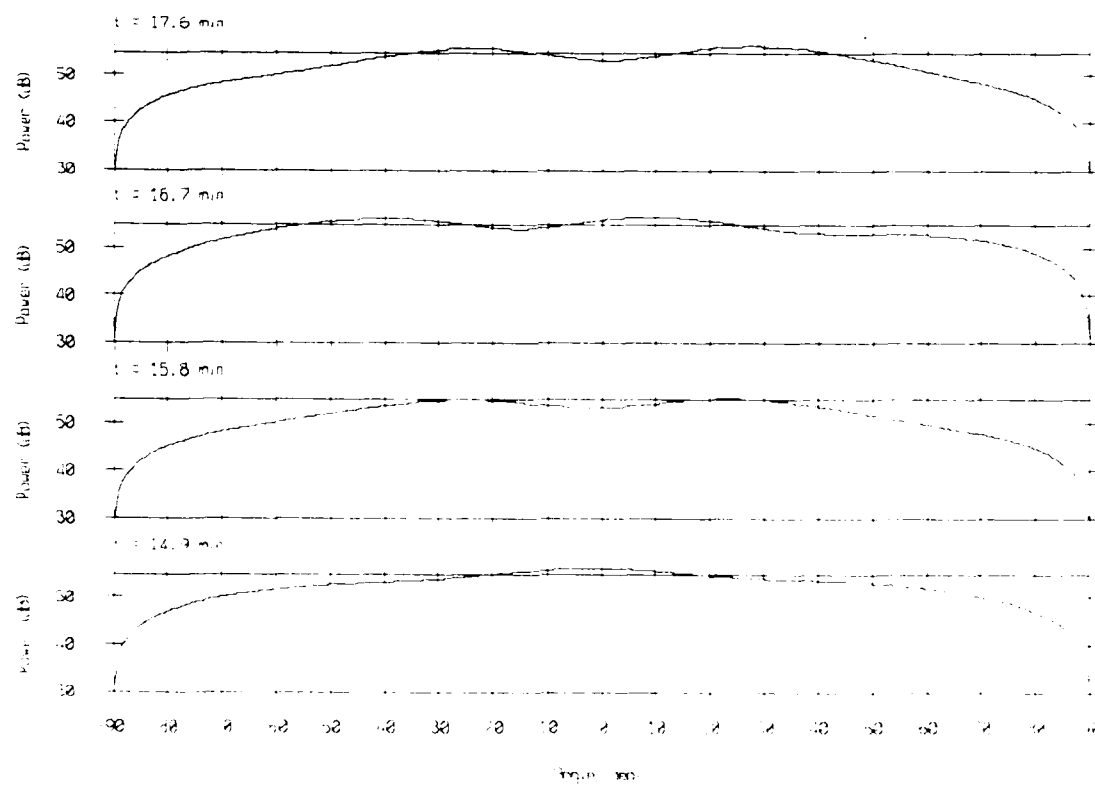
Array Response - 86180 Bin #4271

$f = 25$ Hz, rect window



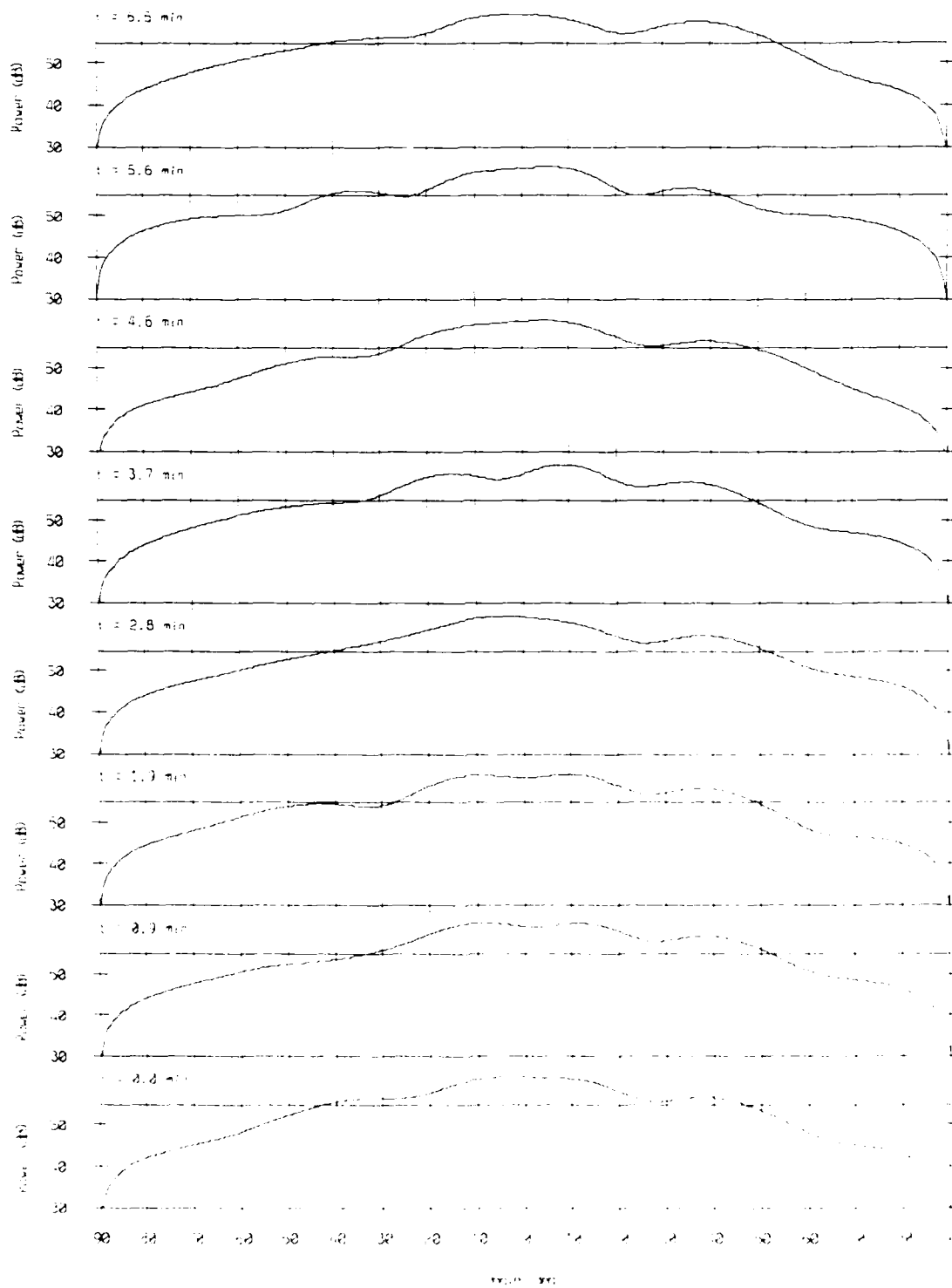
Array Response - 86180 Bin #4271

$f = 25$ Hz, next window



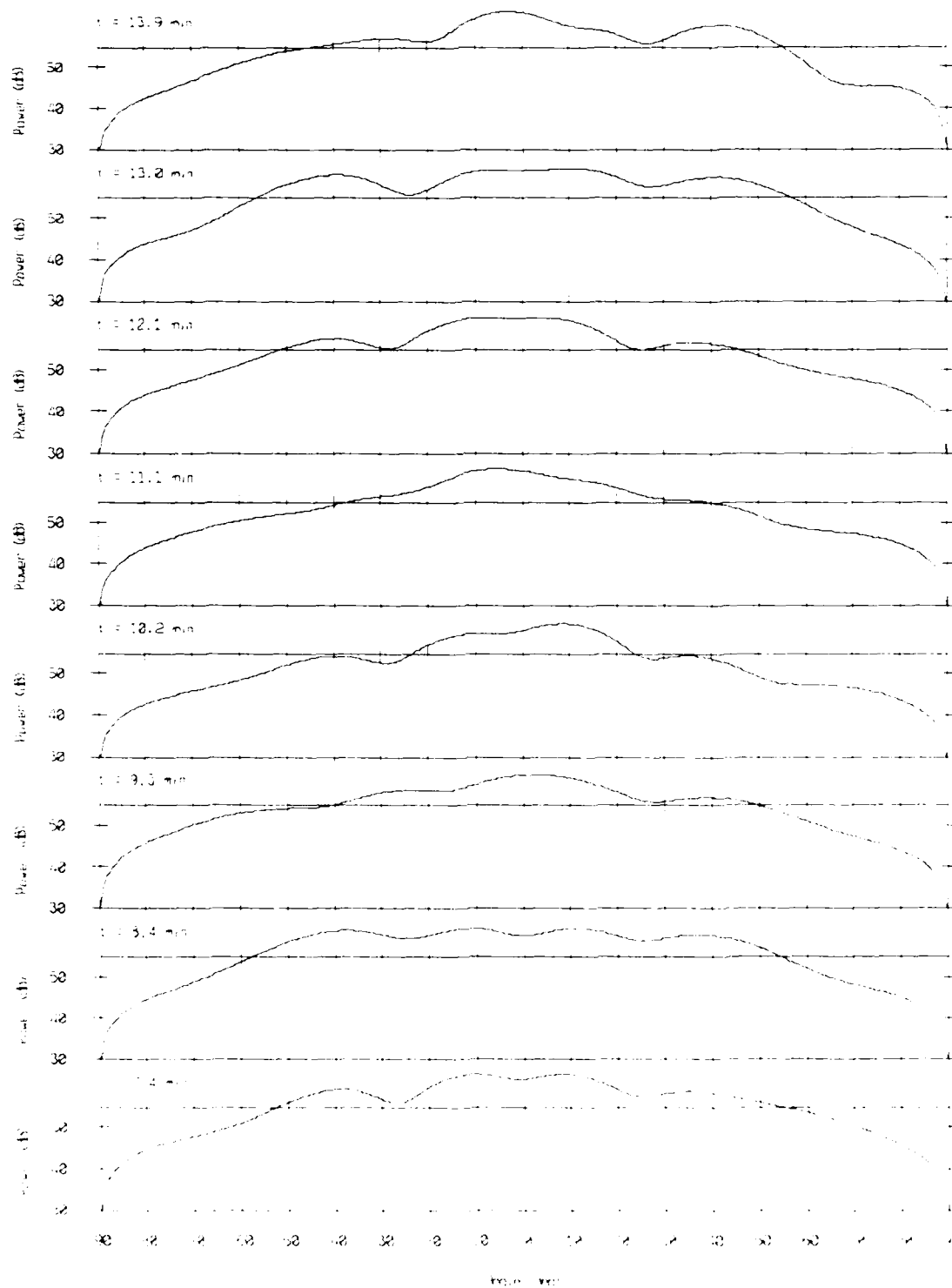
Array Response - 86180 3in #4445

$\Delta = 50$ Hz. rect window



Array Response - 86180 3in #4445

$\Delta = 50$ Hz, rect window



Array Response - 86180 Bin #4445

$f = 50$ Hz, next window

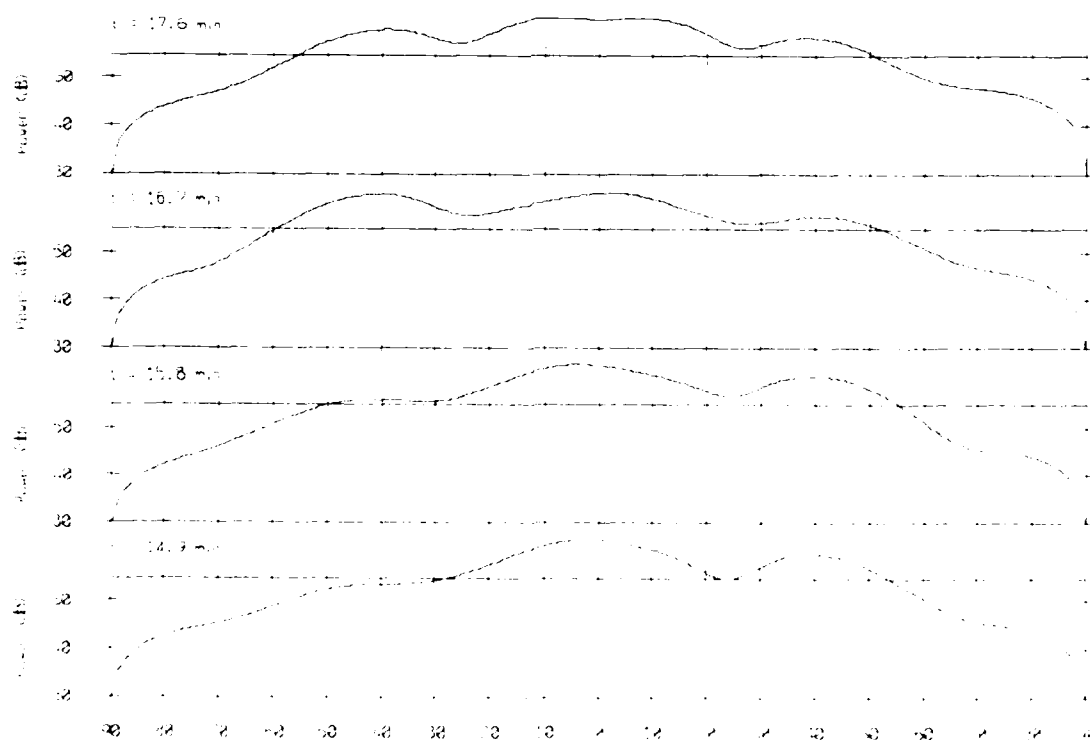
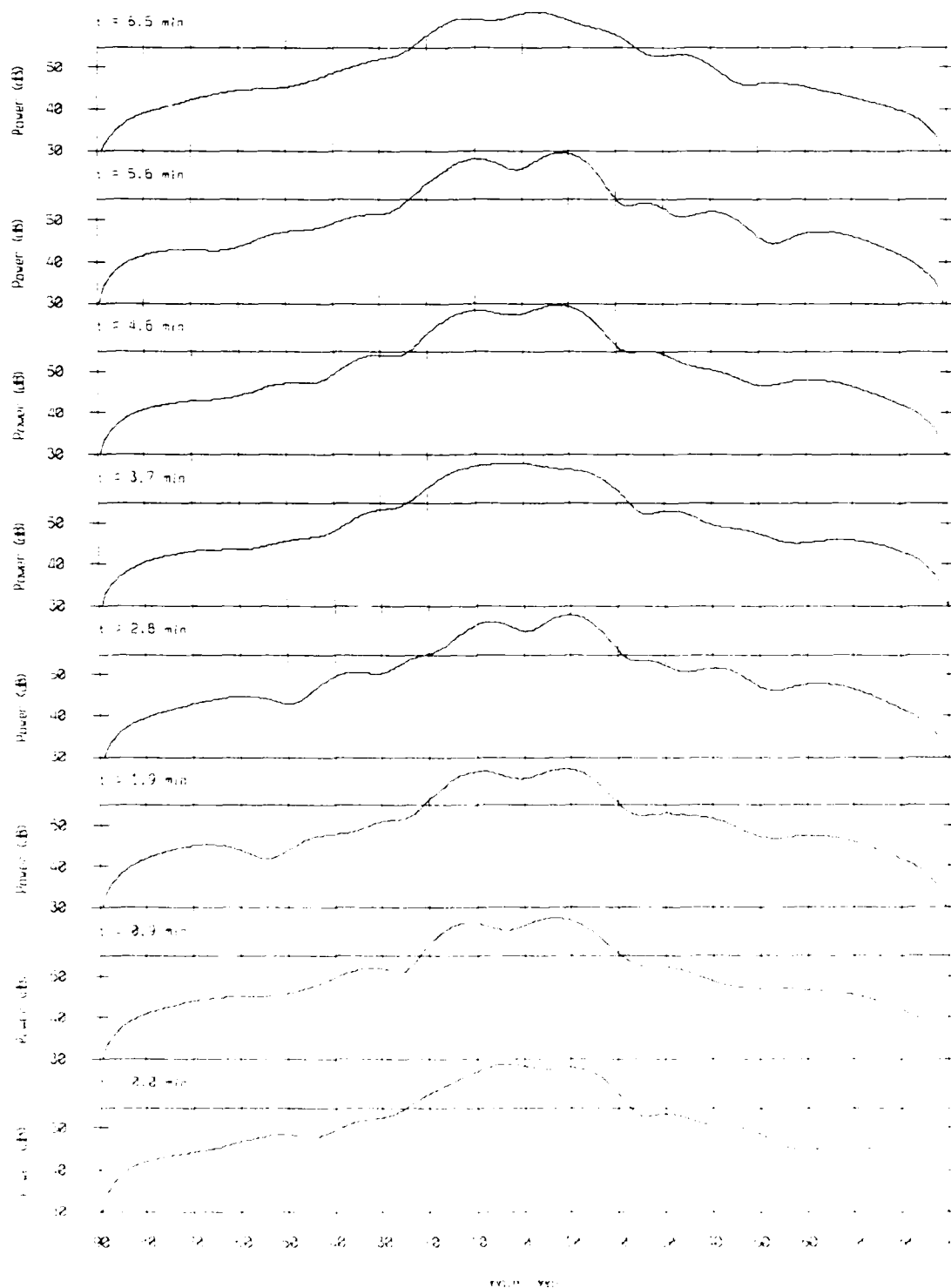


FIGURE 10

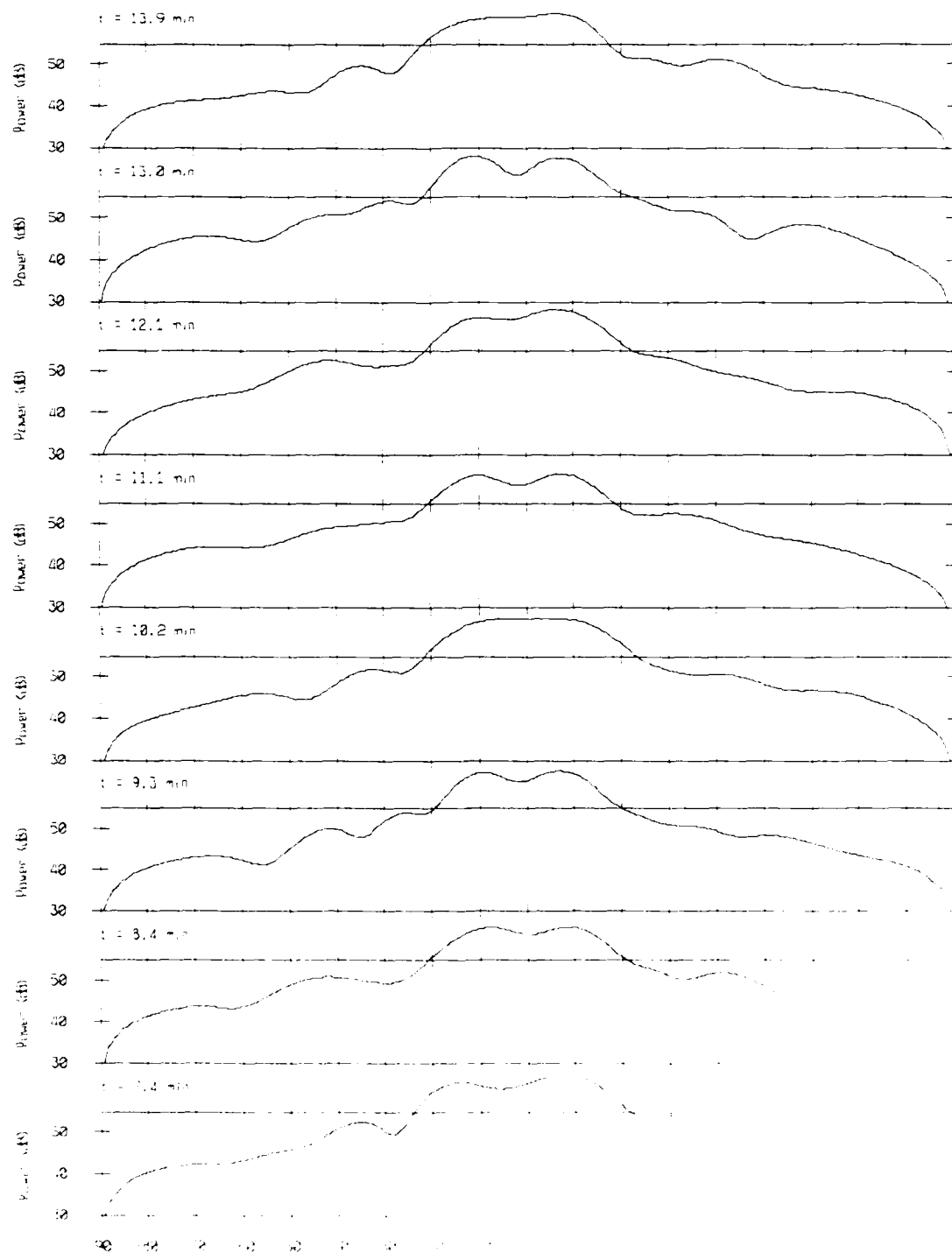
Array Response - 86180 Bin #4619

$\theta = 75^\circ$ - z, next window



Array Response - 86180 Bin #4619

$f = 75$ Hz, rect window



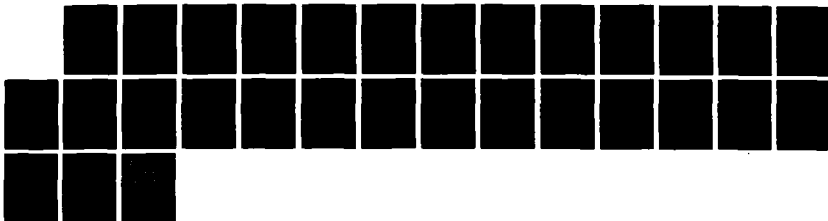
AD-A193 228 VERTICAL DIRECTIONALITY OF AMBIENT NOISE AT 32 DEG N AS 2/2

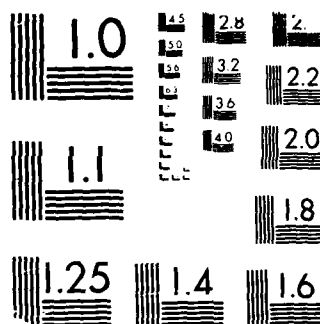
A FUNCTION OF LON. (U) SCRIPPS INSTITUTION OF
OCEANOGRAPHY LA JOLLA CA MARINE PHYSIC.

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F/G 20/1

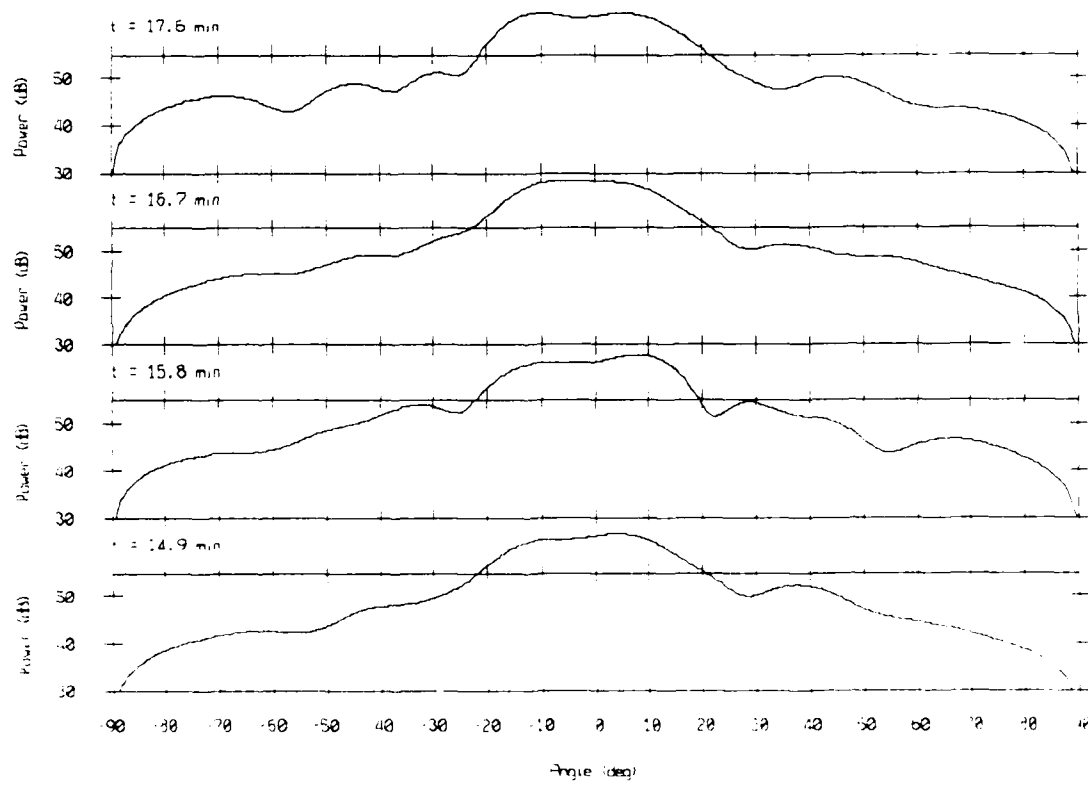
NL





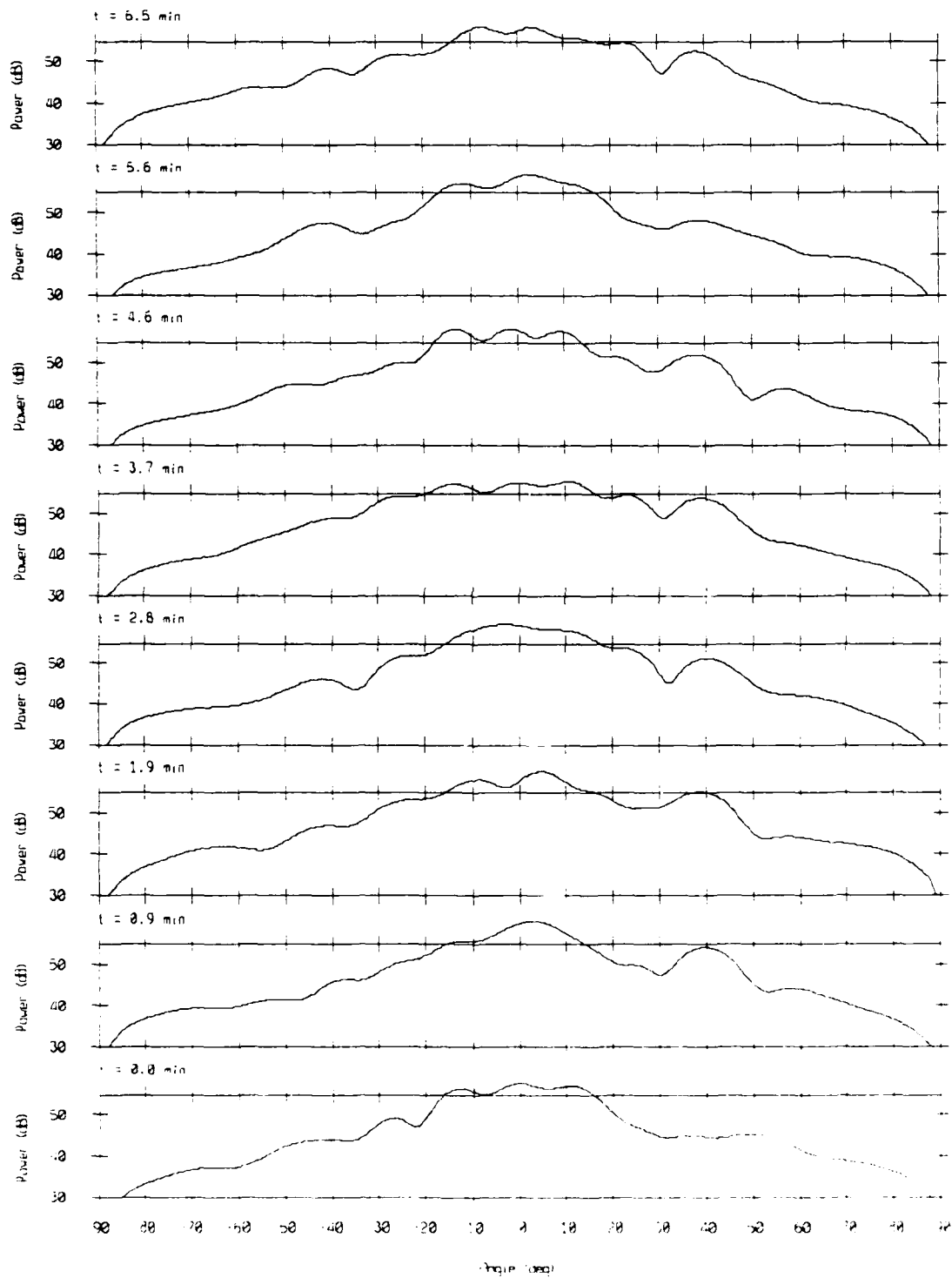
Array Response - 86180 Bin #4619

$f = 75$ Hz, rect window



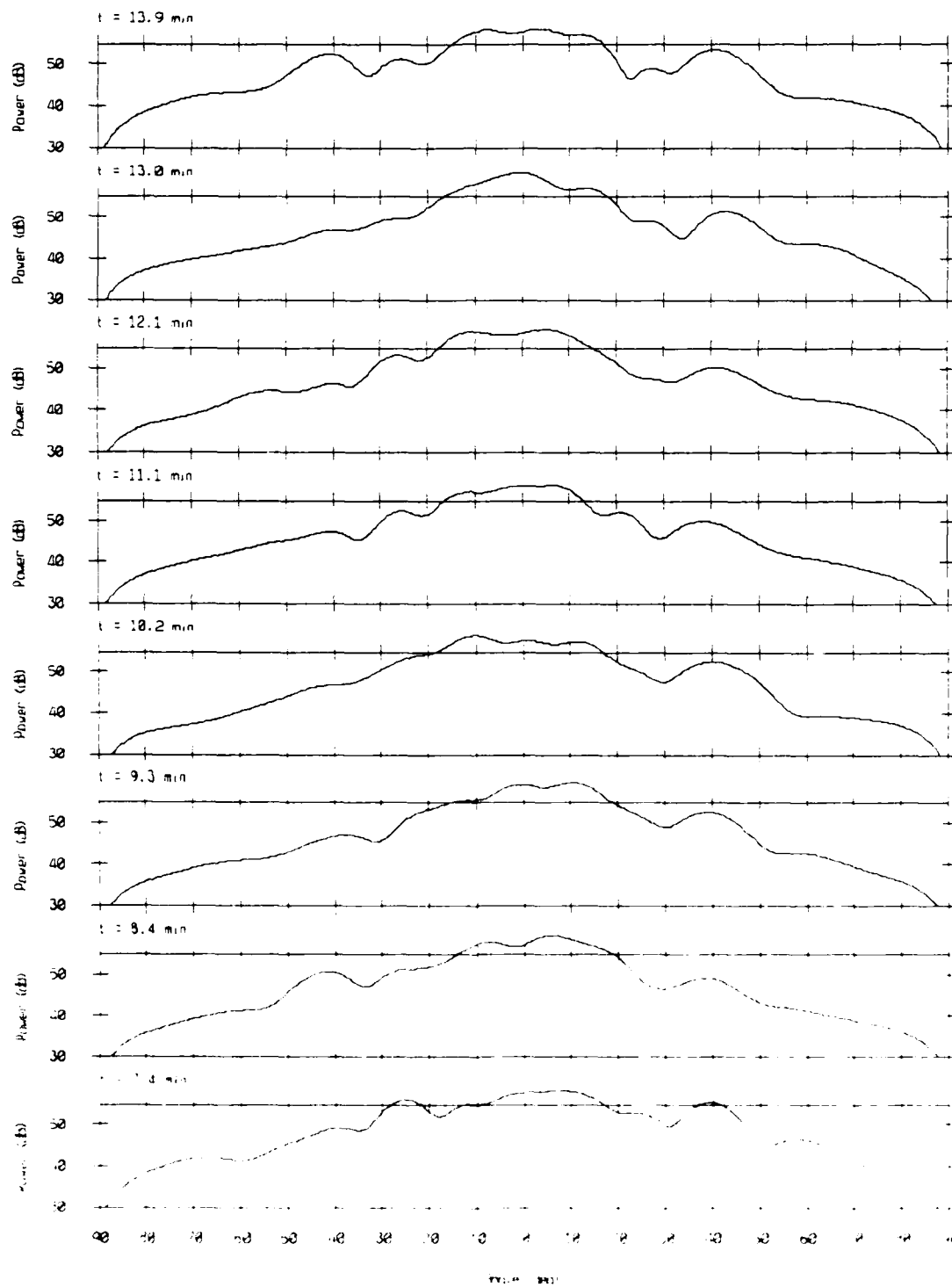
Array Response - 86180 Bin #4793

$f = 100$ Hz, rect window



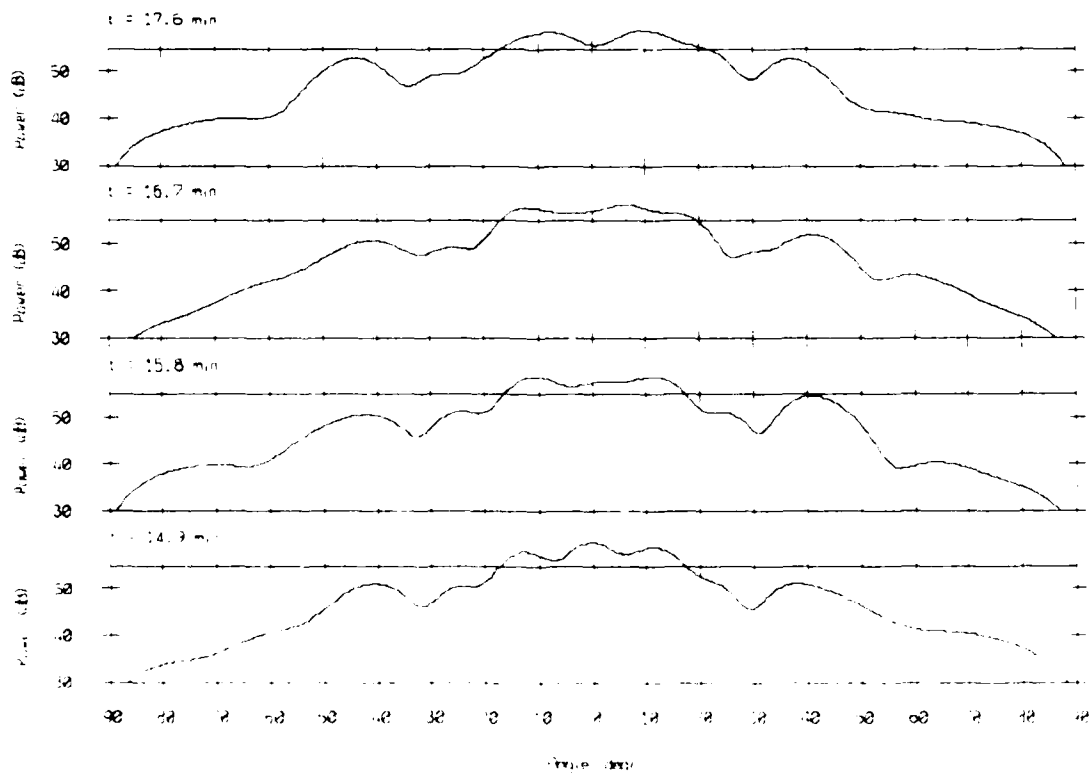
Array Response - 86180 Bin #4793

$f = 100$ Hz, rect window



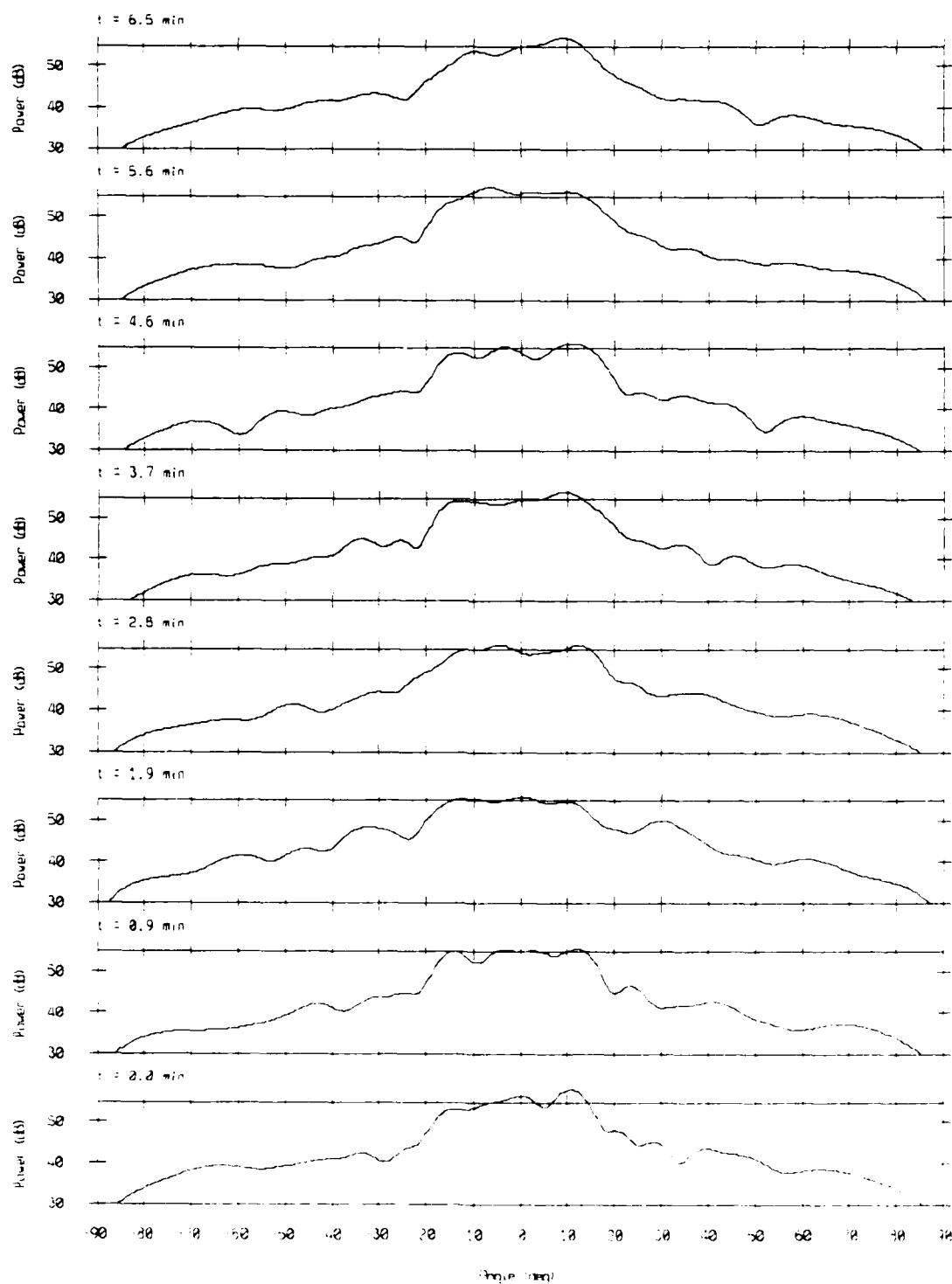
Array Response - 86180 Bin #4793

$f = 100$ Hz, rect window



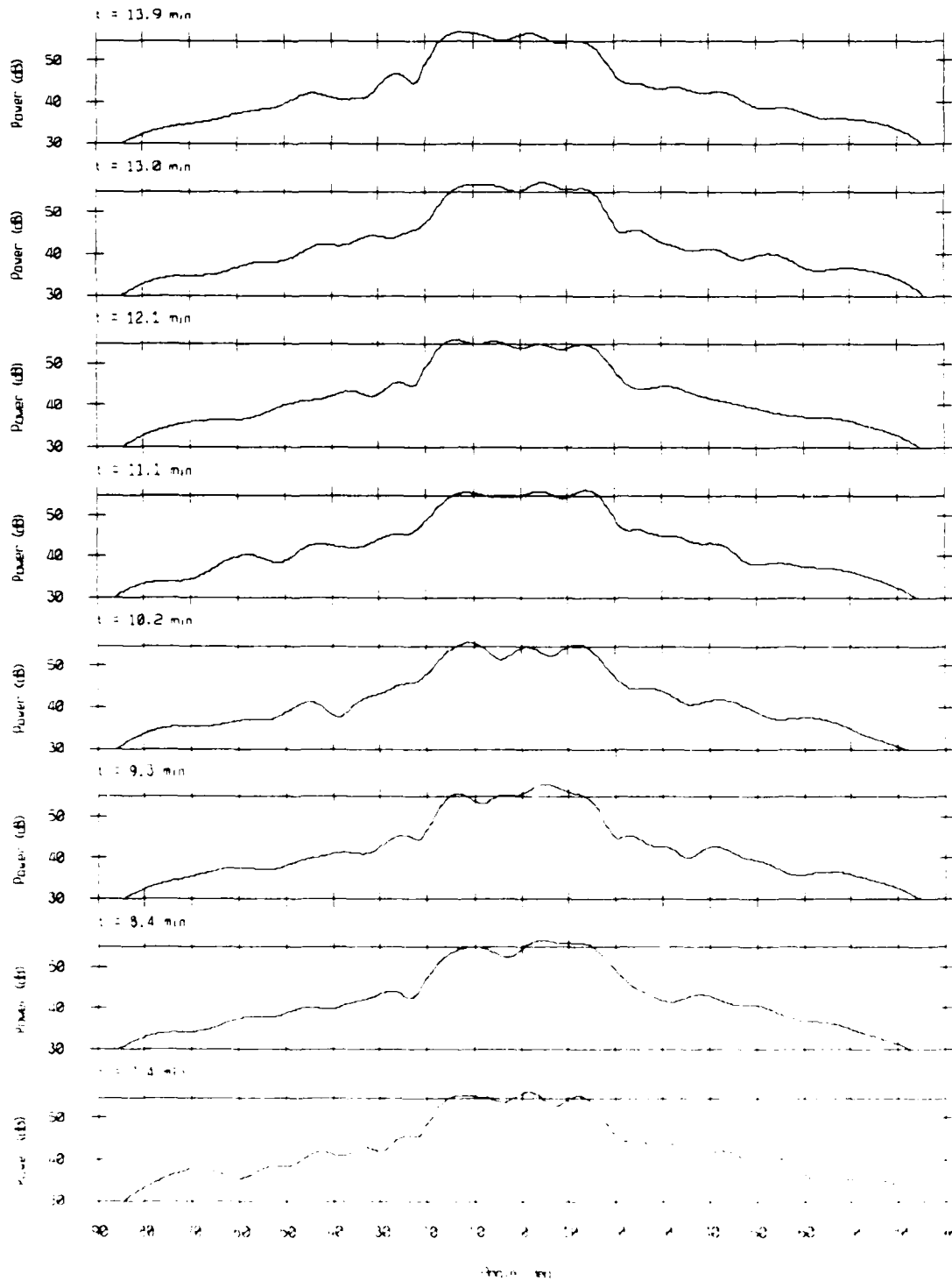
Array Response - 86180 Bin #4967

$f = 125$ Hz, rect window



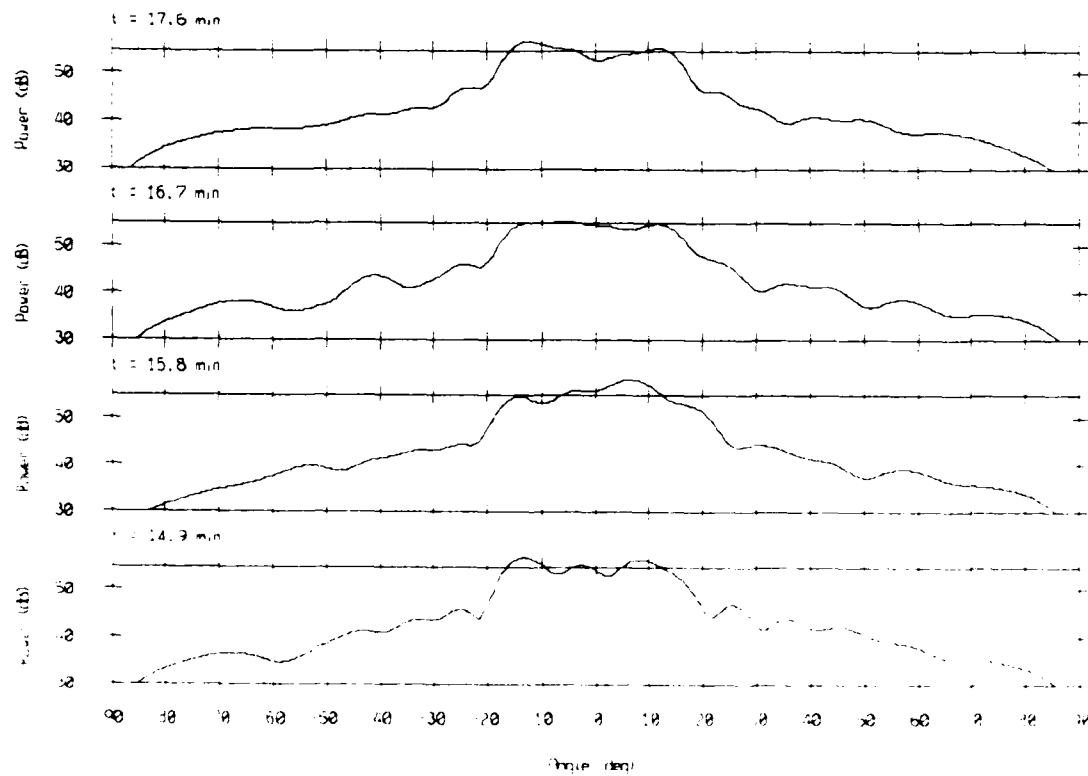
Array Response - 86180 Bin #4967

$f = 125$ Hz, rect window



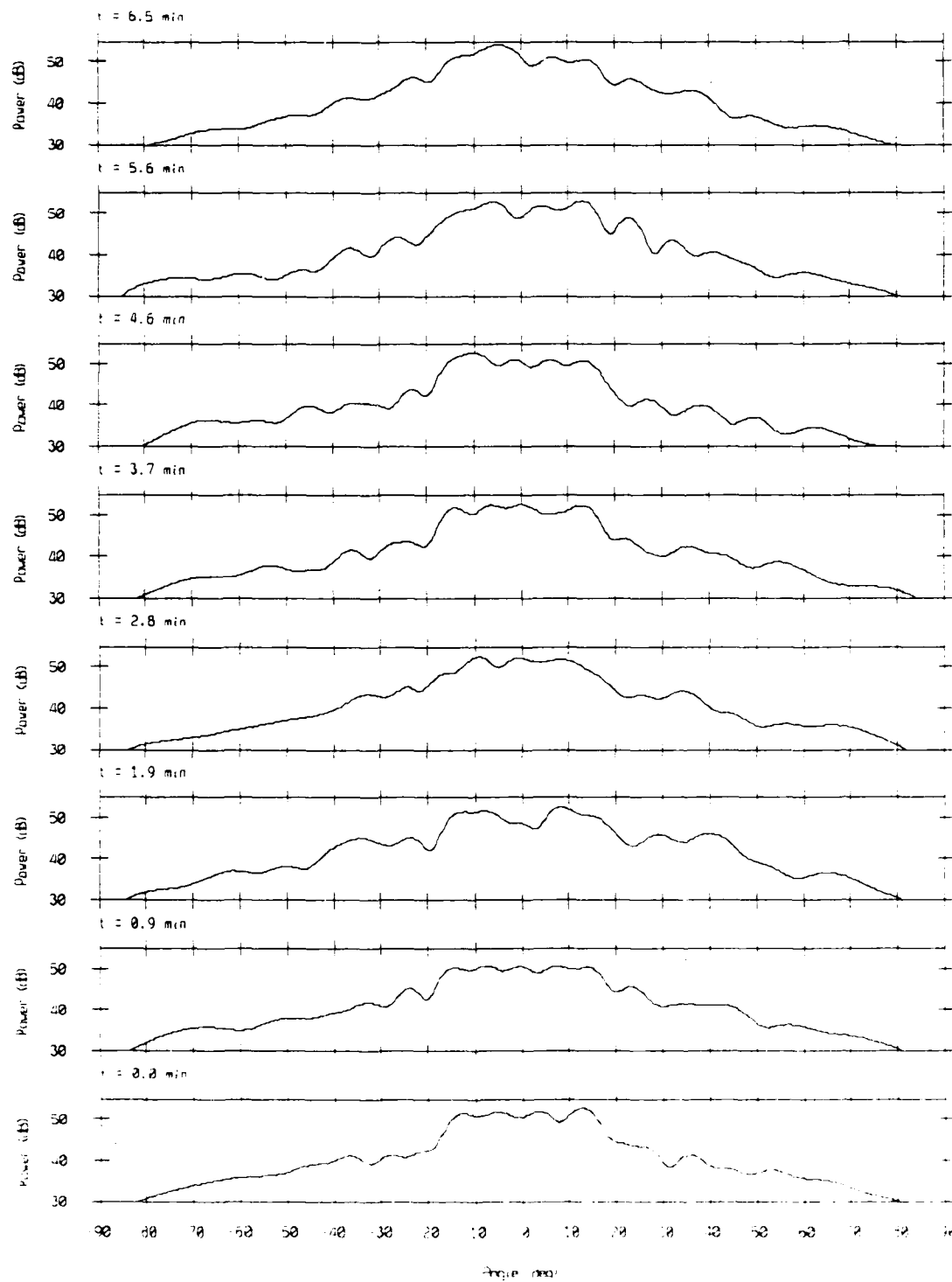
Array Response - 86180 Bin #4967

$\Delta f = 125$ Hz, rect window



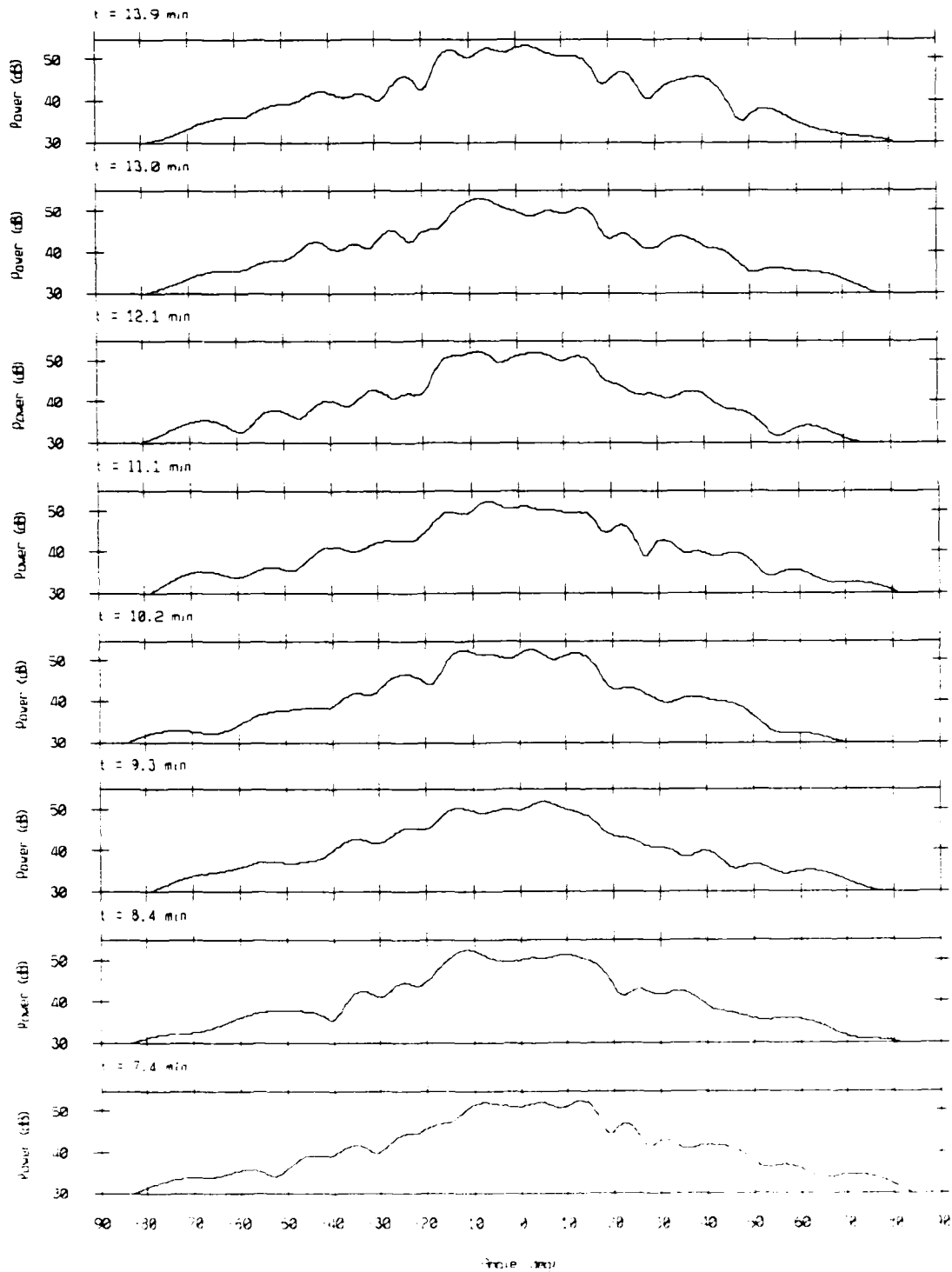
Array Response - 86180 Bin #5141

$f = 150$ Hz, rect window



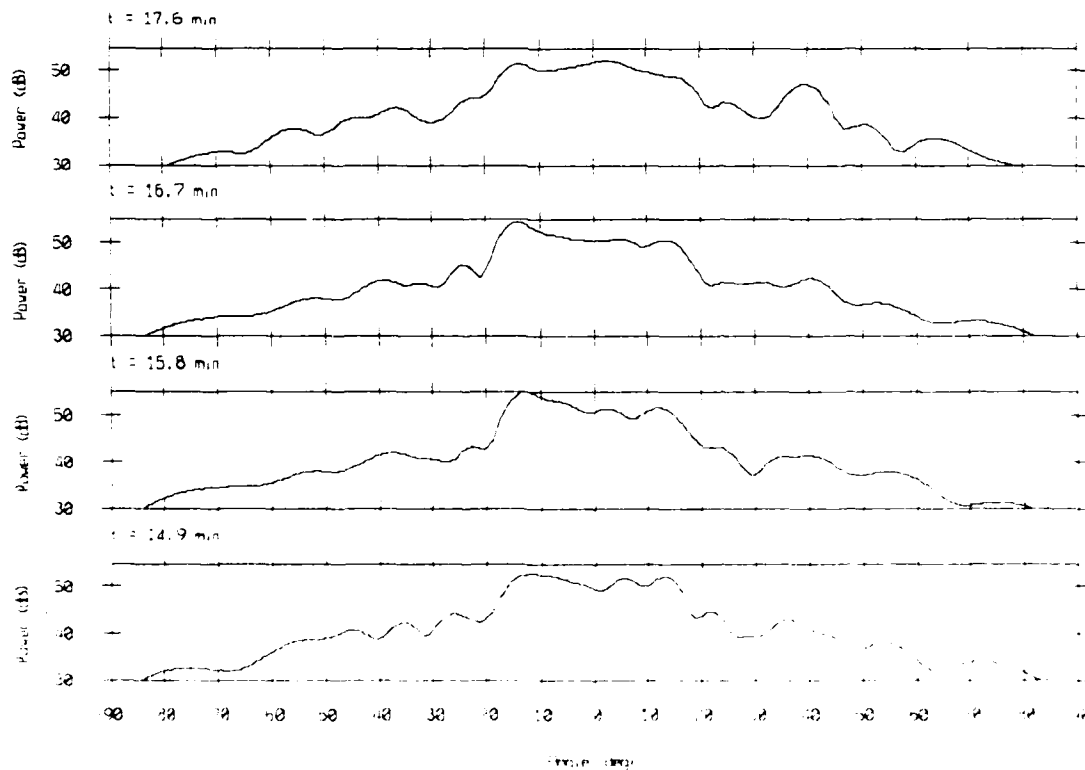
Array Response - 86180 Bin #5141

$f = 150$ Hz, rect window



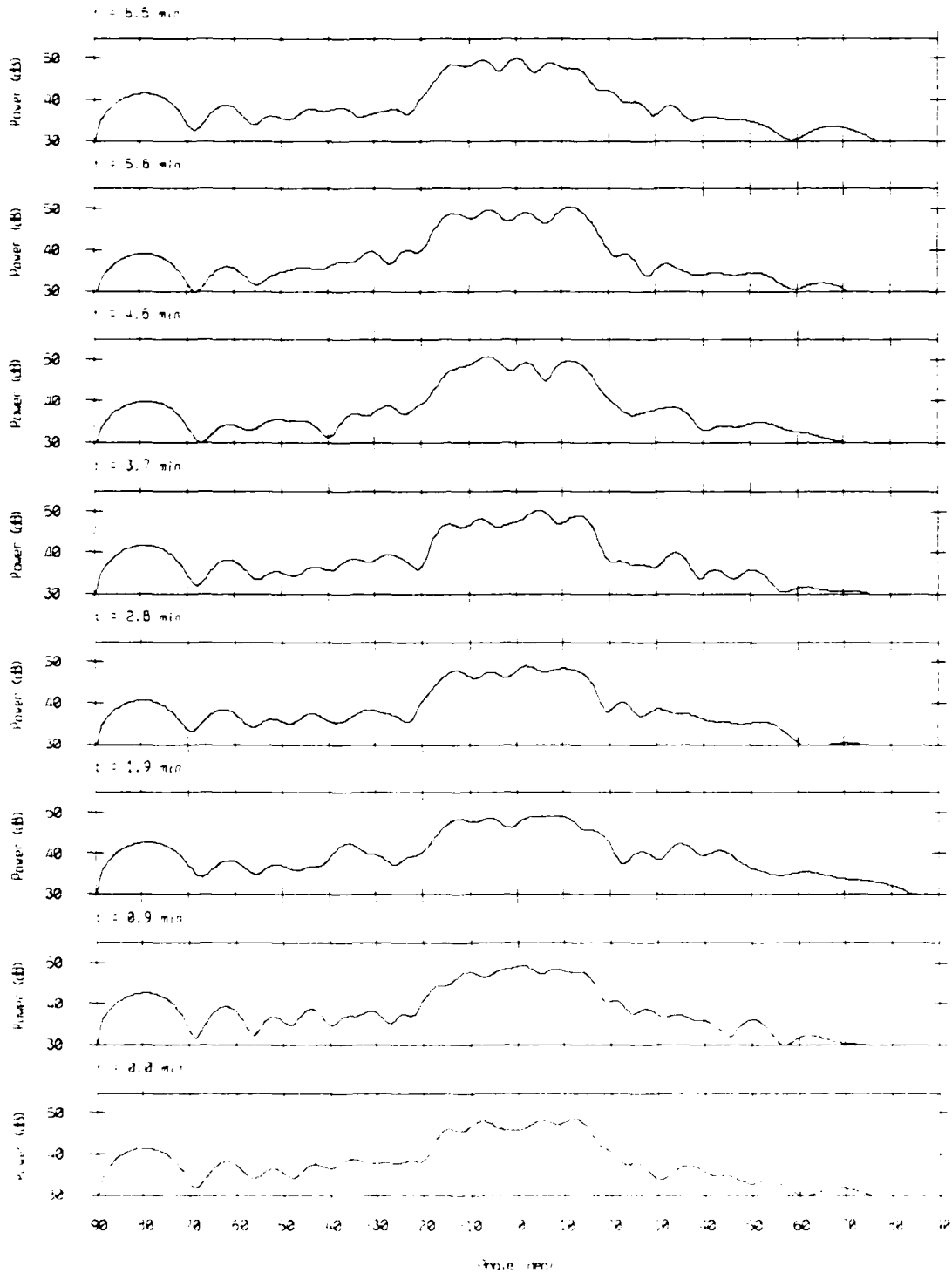
Array Response - 86180 Bin #5141

$f = 150$ Hz, rect window



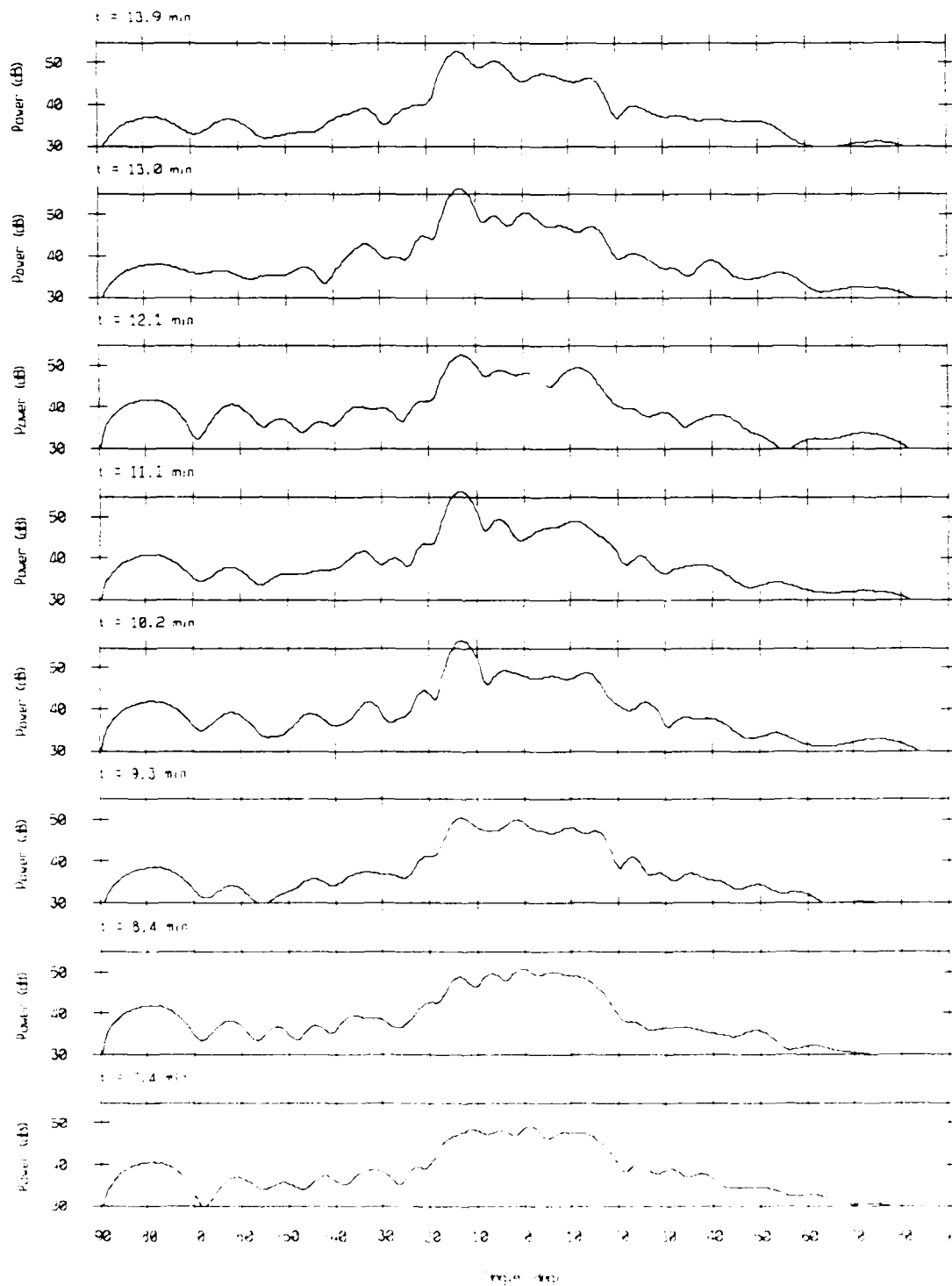
Array Response - 86180 Bin #5316

$\Delta = 175$ Hz, rect window



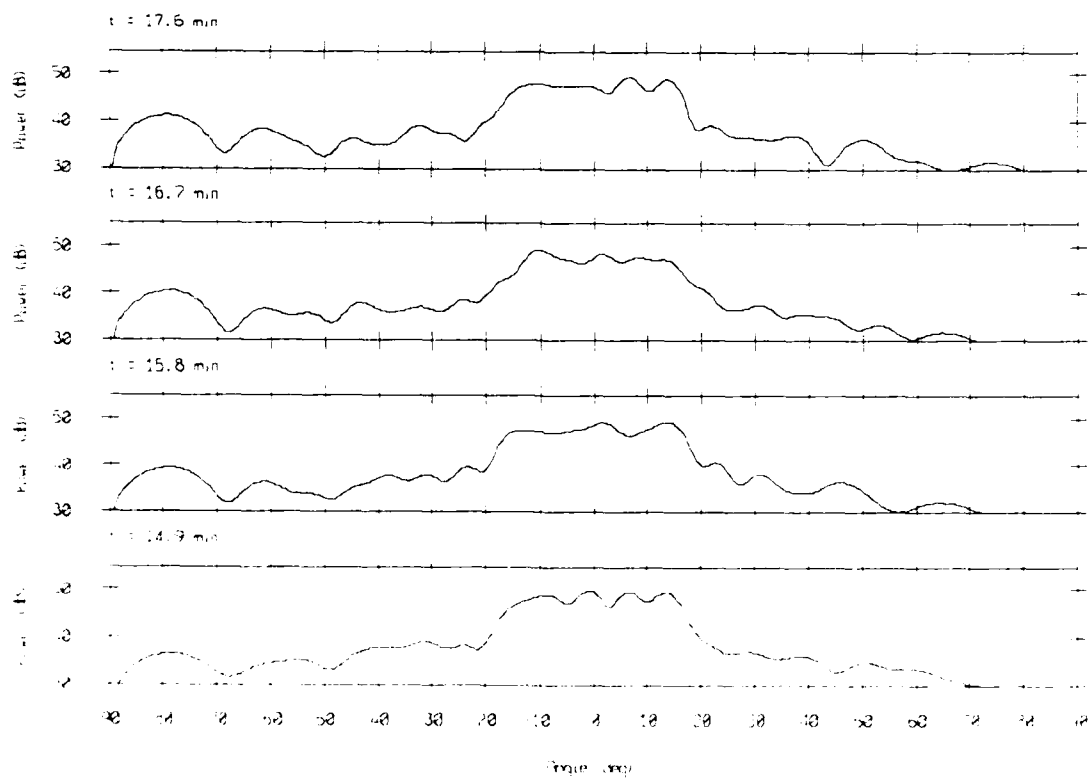
Array Response - 86180 Bin #5316

$f = 175$ Hz, rect window



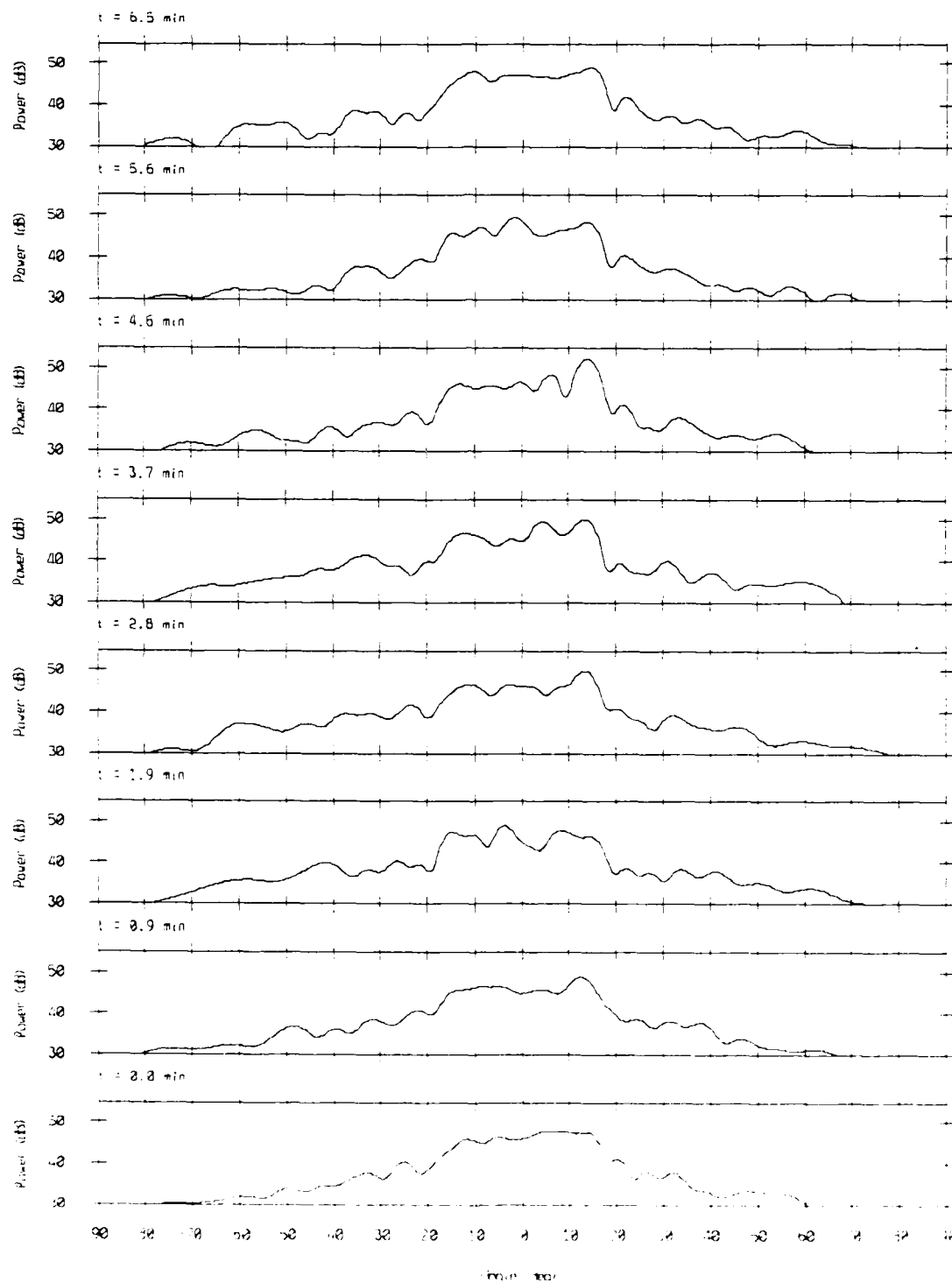
Array Response - 86180 Bin #5316

$f = 175$ Hz, rect window



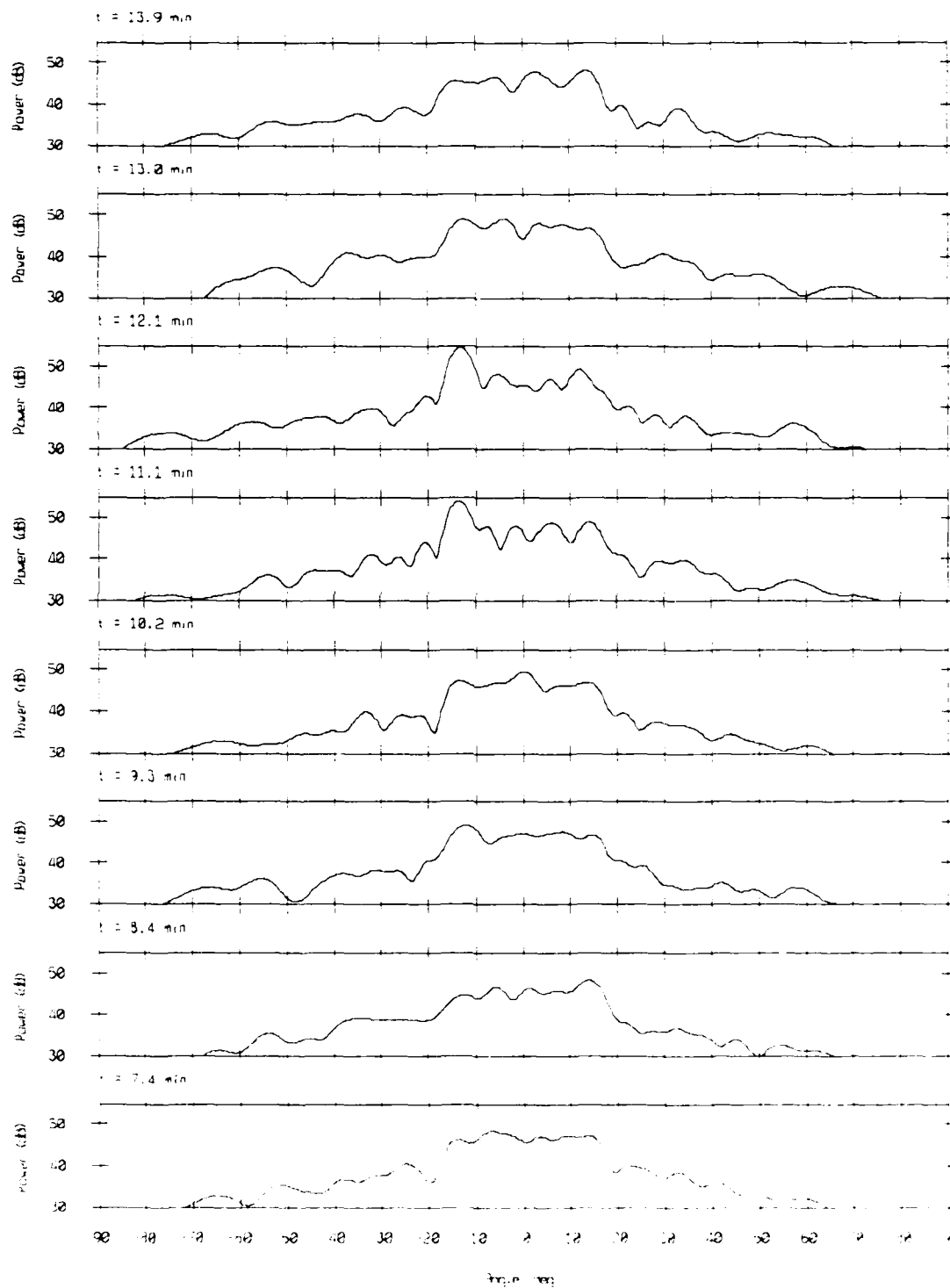
Array Response - 86180 Bin #5490

$f = 200$ Hz, rect window



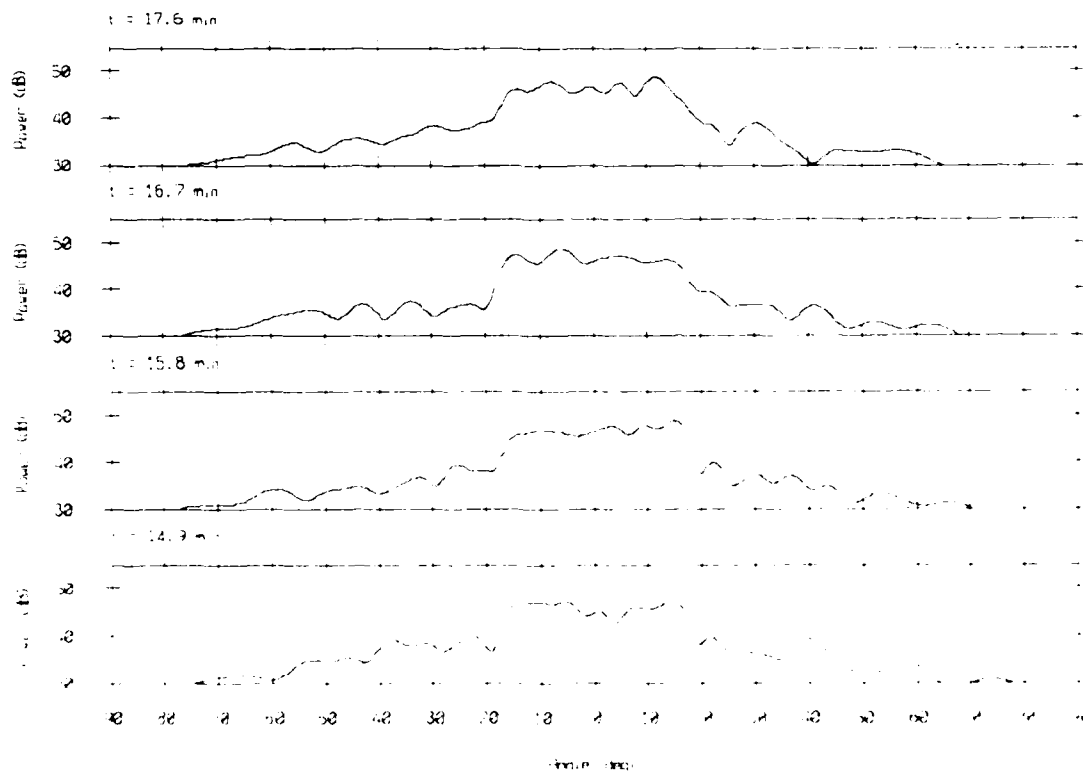
Array Response - 86180 Bin #5490

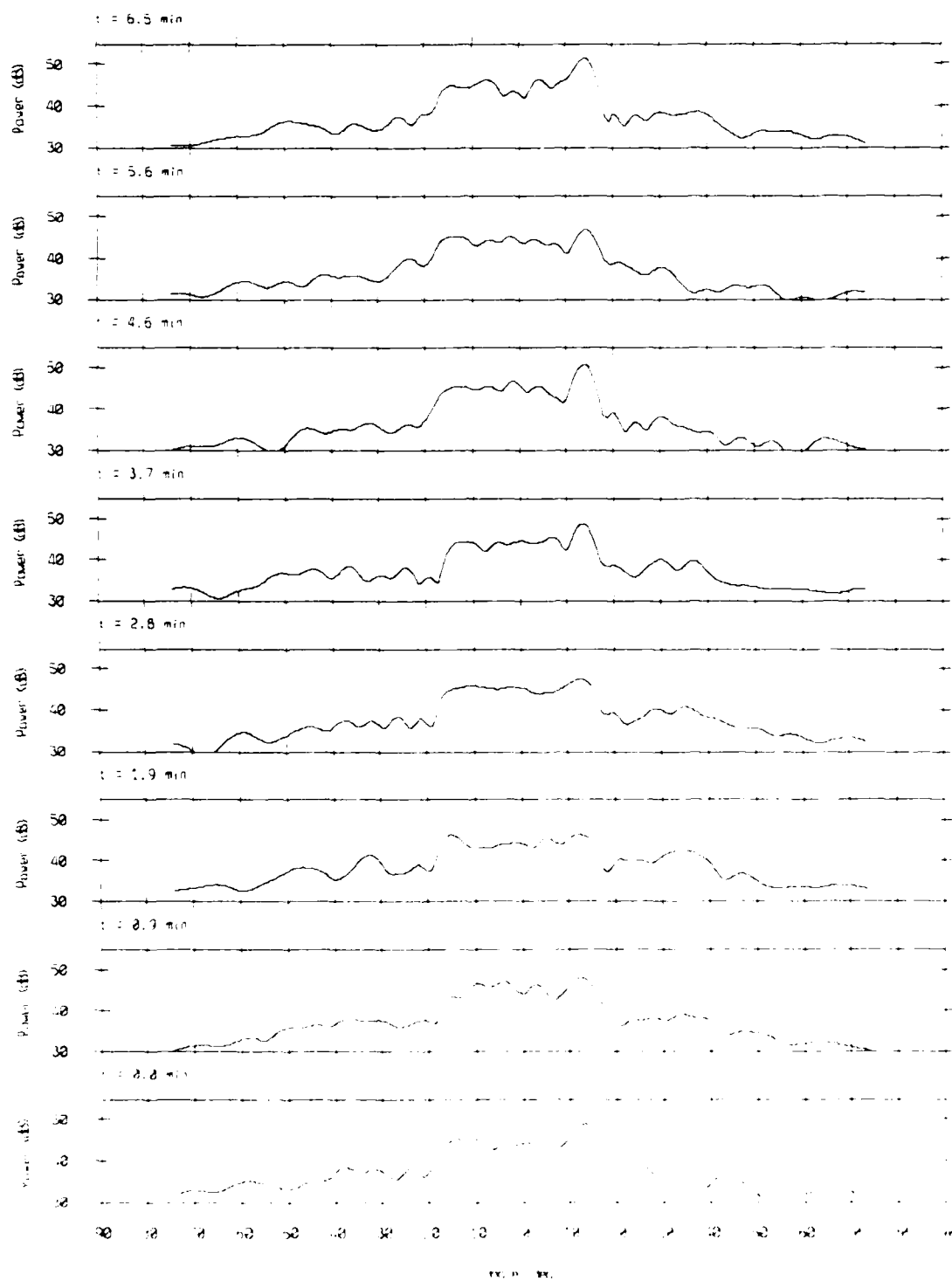
$\Delta f = 200$ Hz, rect window



Array Response - 86180 Bin #5490

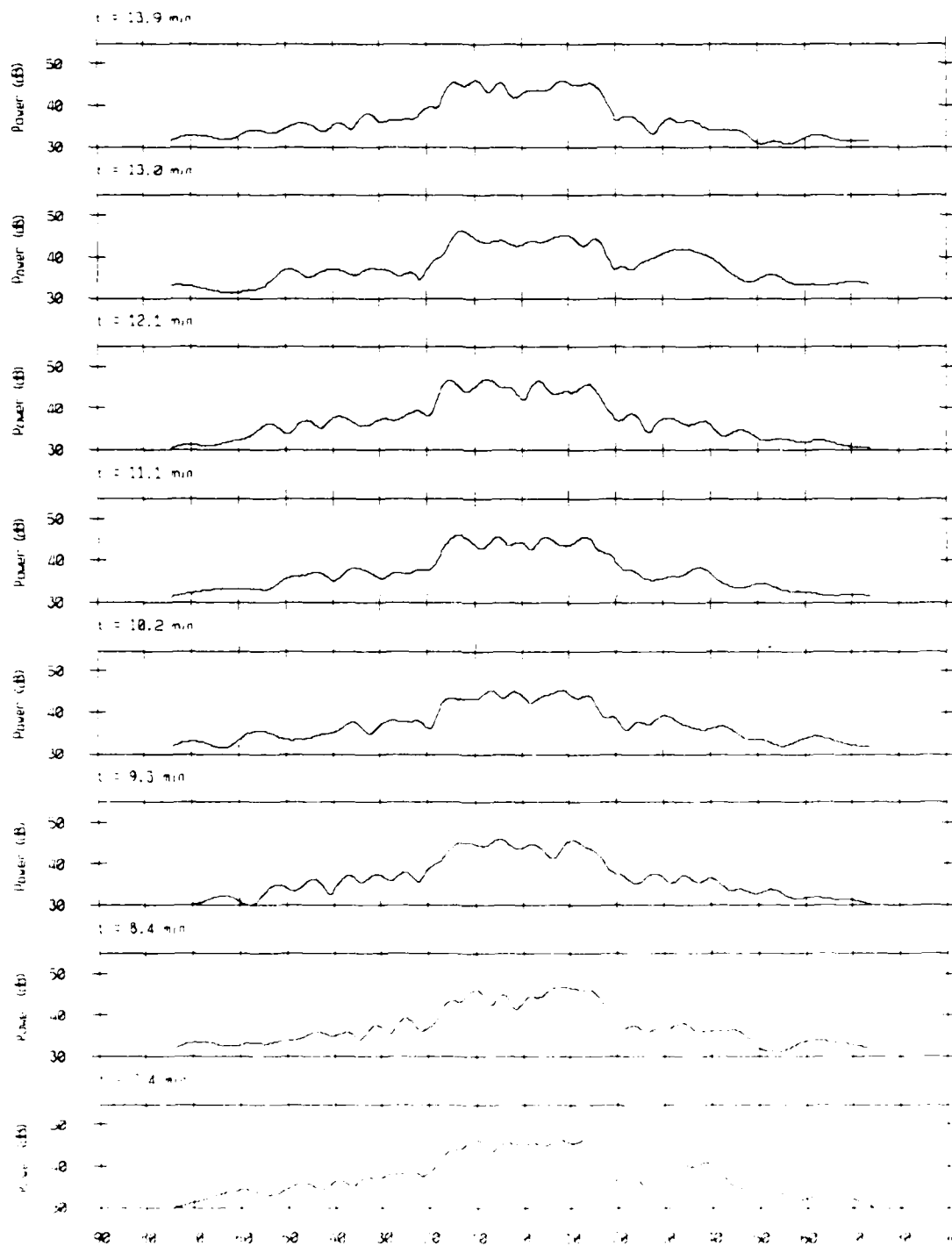
$f = 200$ Hz, rect window



$$\hat{f} = 225 - z, \text{ rect window}$$
$$\hat{f} = 225 - z, \text{ rect window}$$


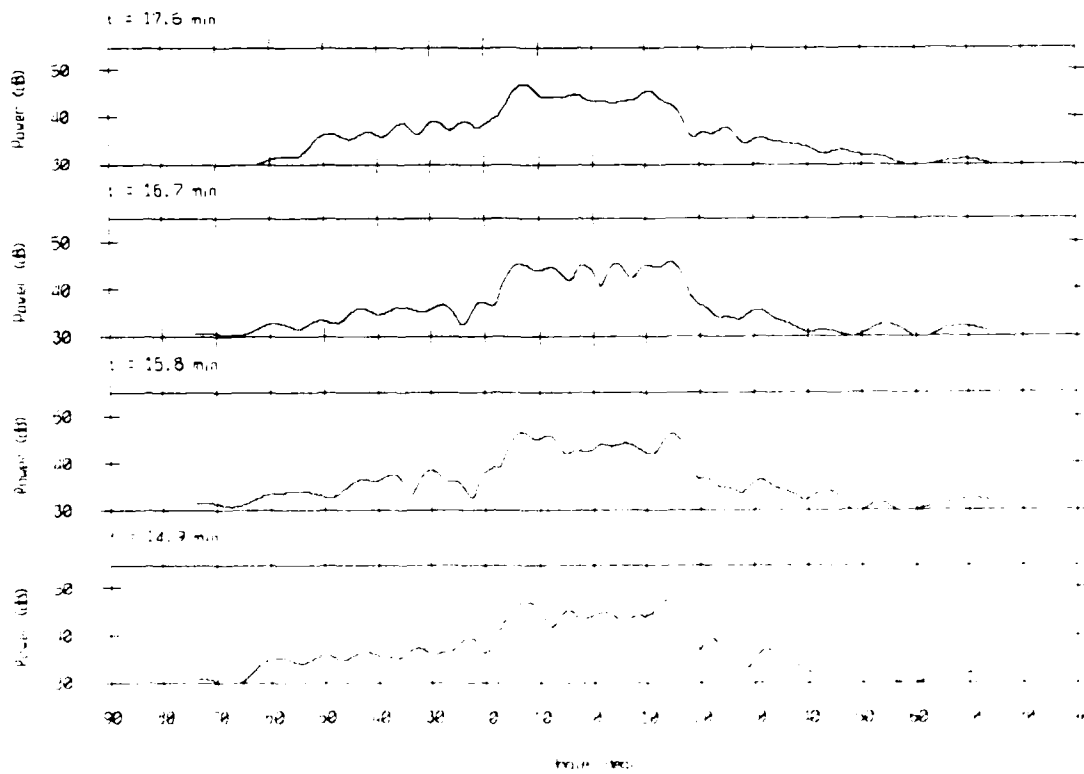
Array Response - 86180 Bin #5664

$f = 225$ Hz, rect window



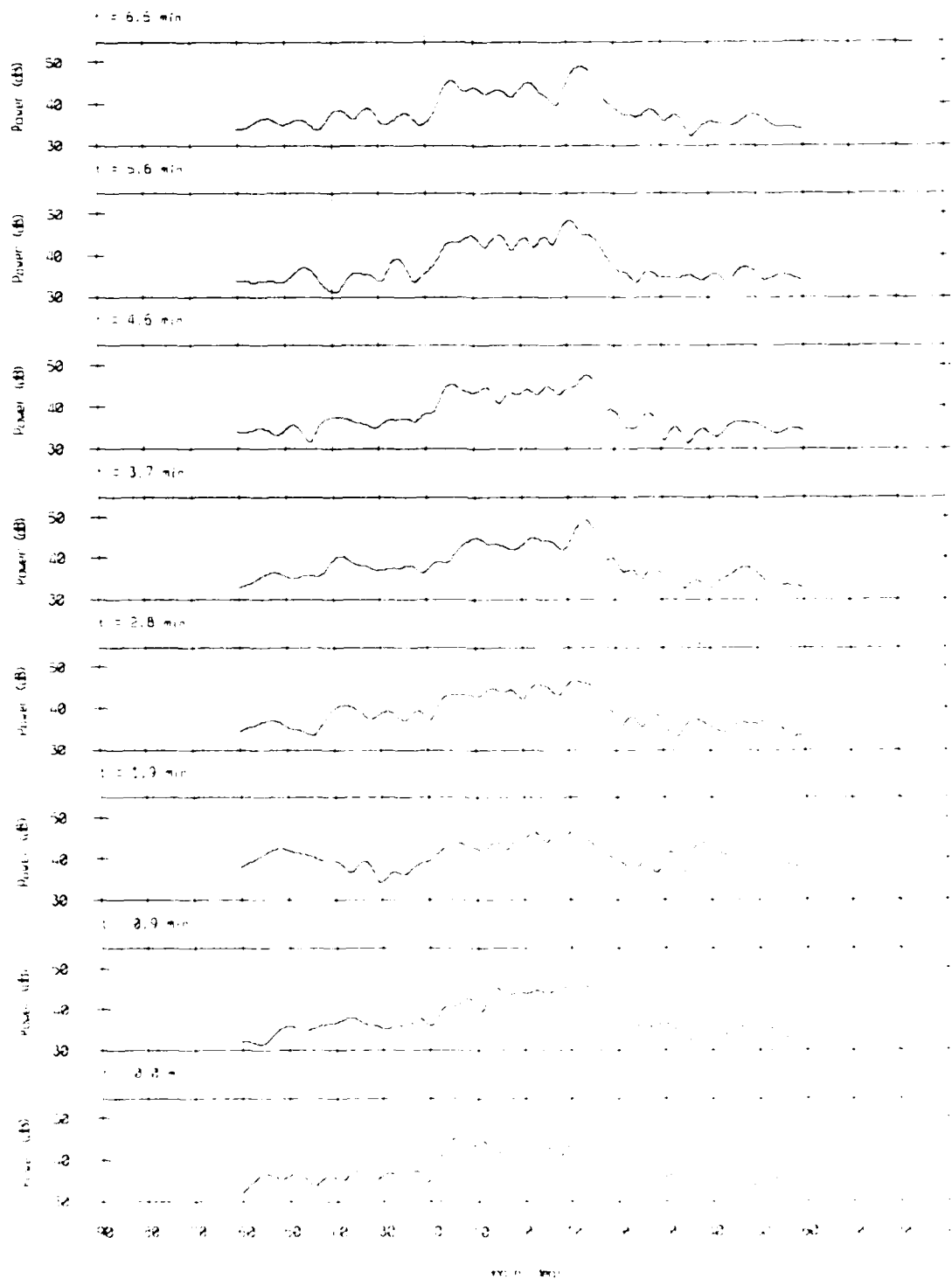
Array Response - 86180 Bin #5664

$f = 225$ Hz, rect window



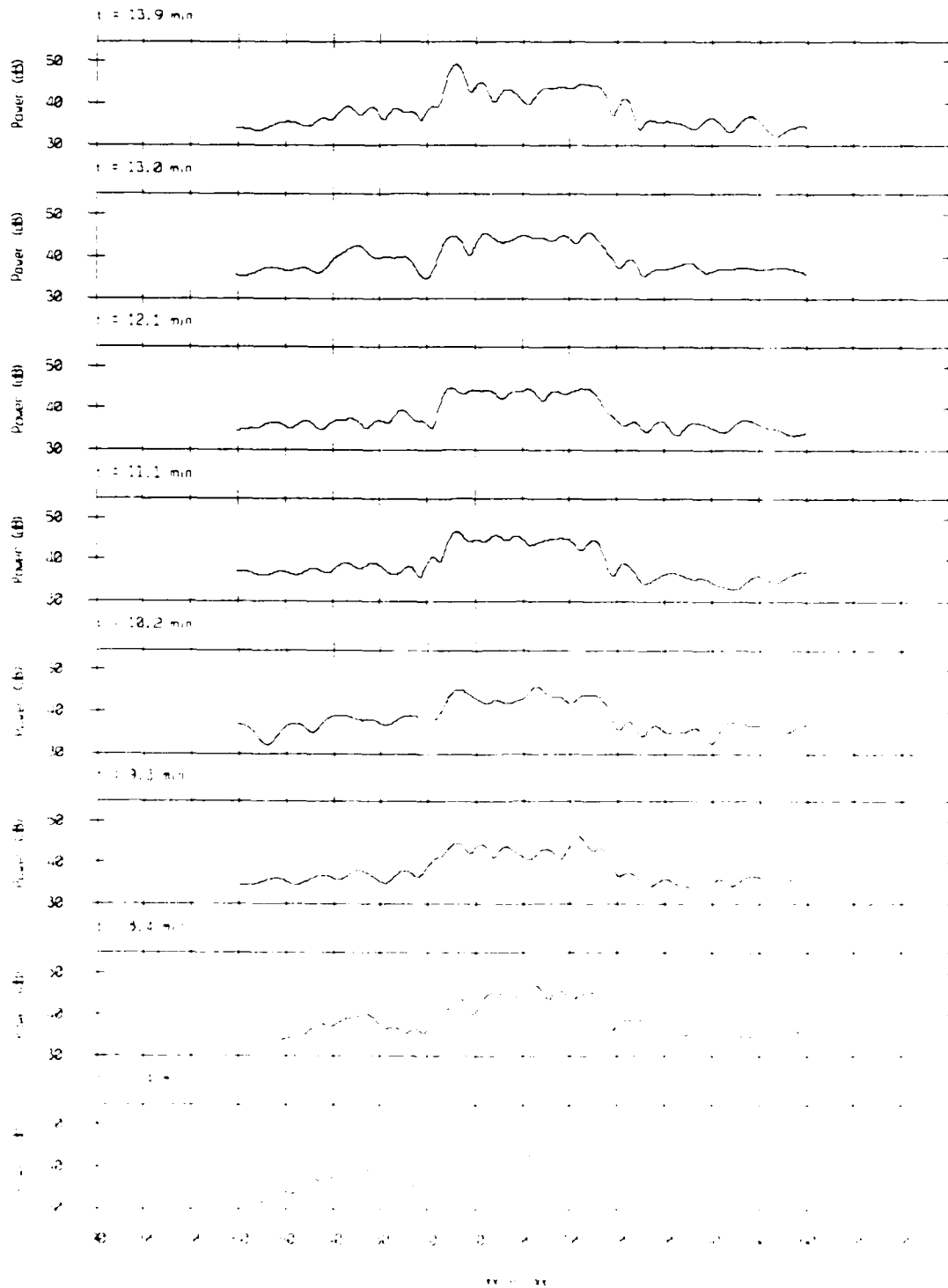
Array Response - 86180 Bin #5832

$f = 252$ Hz, rect window



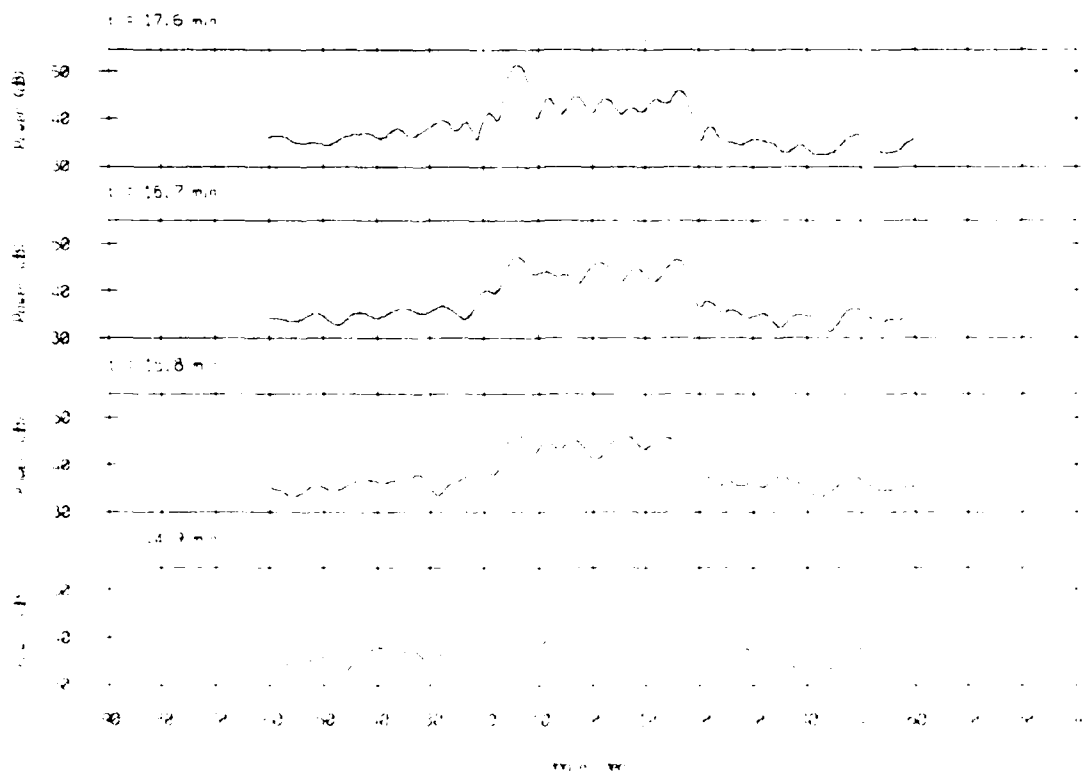
Array Response - 86180 Bin #5832

$f = 250$ Hz, rect window



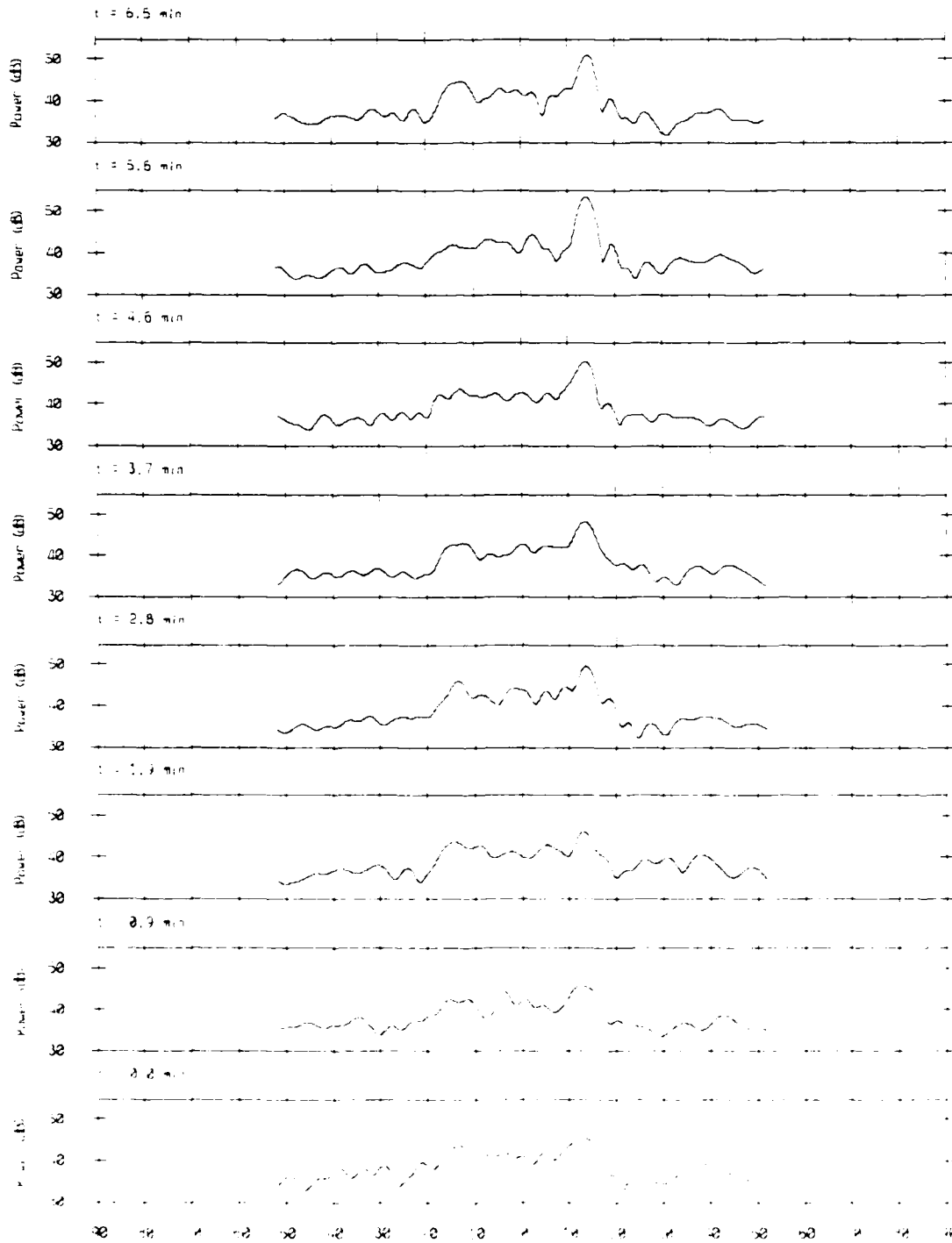
Array Response - 86180 Bin #5832

$f = 250$ Hz, rect window



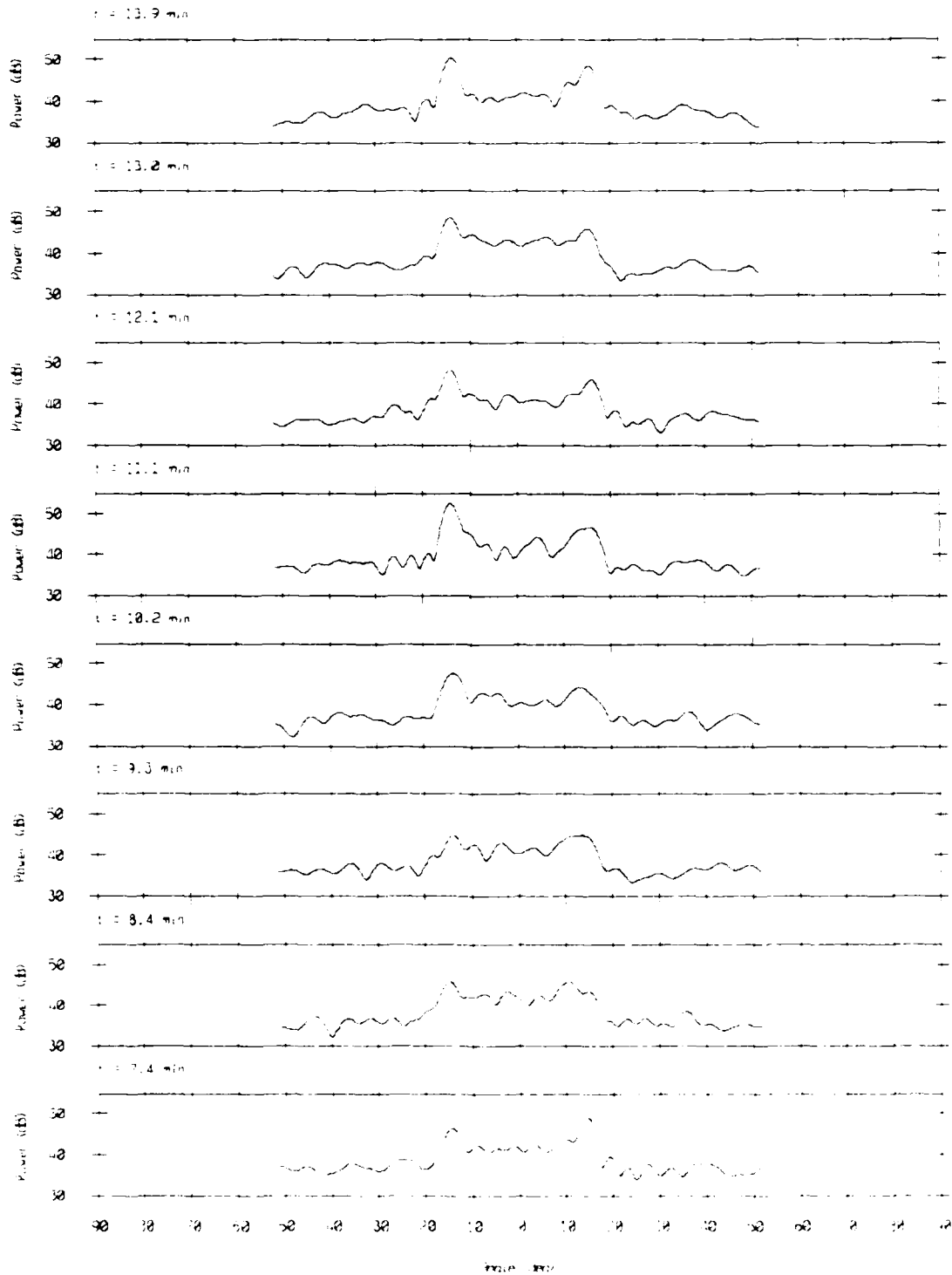
Array Response - 86180 Bin #6012

$\Delta = 275$ Hz, rect window



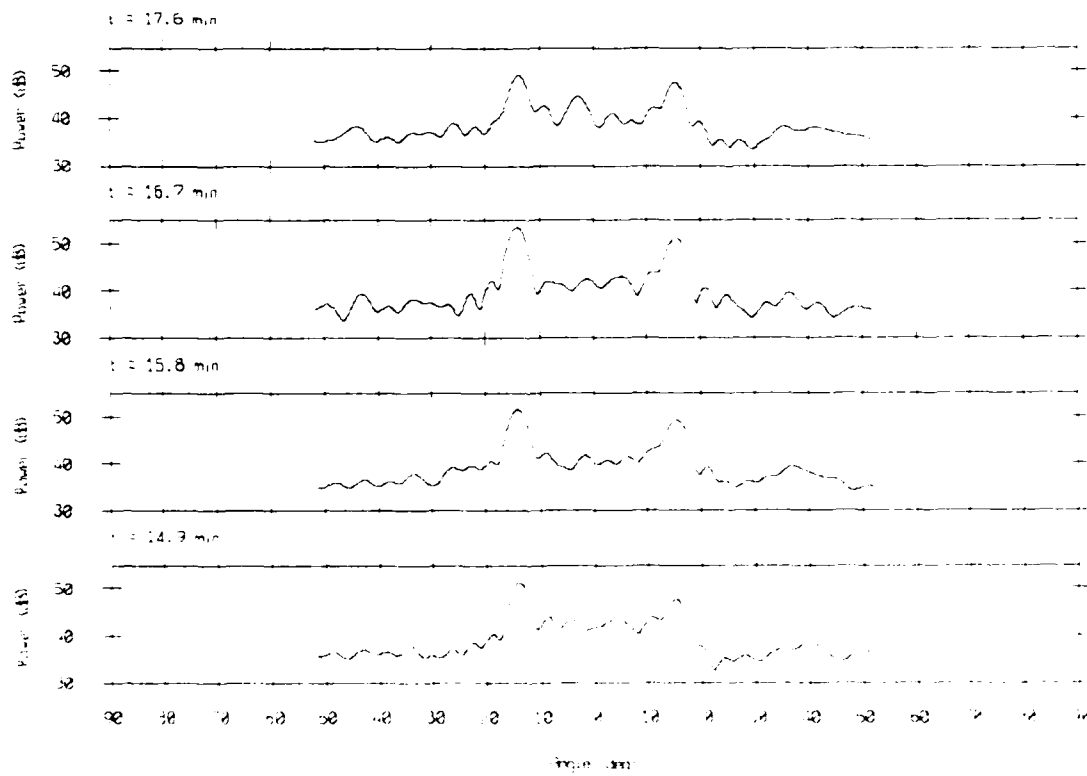
Array Response - 86180 Bin #6012

$f = 275$ Hz, rect window



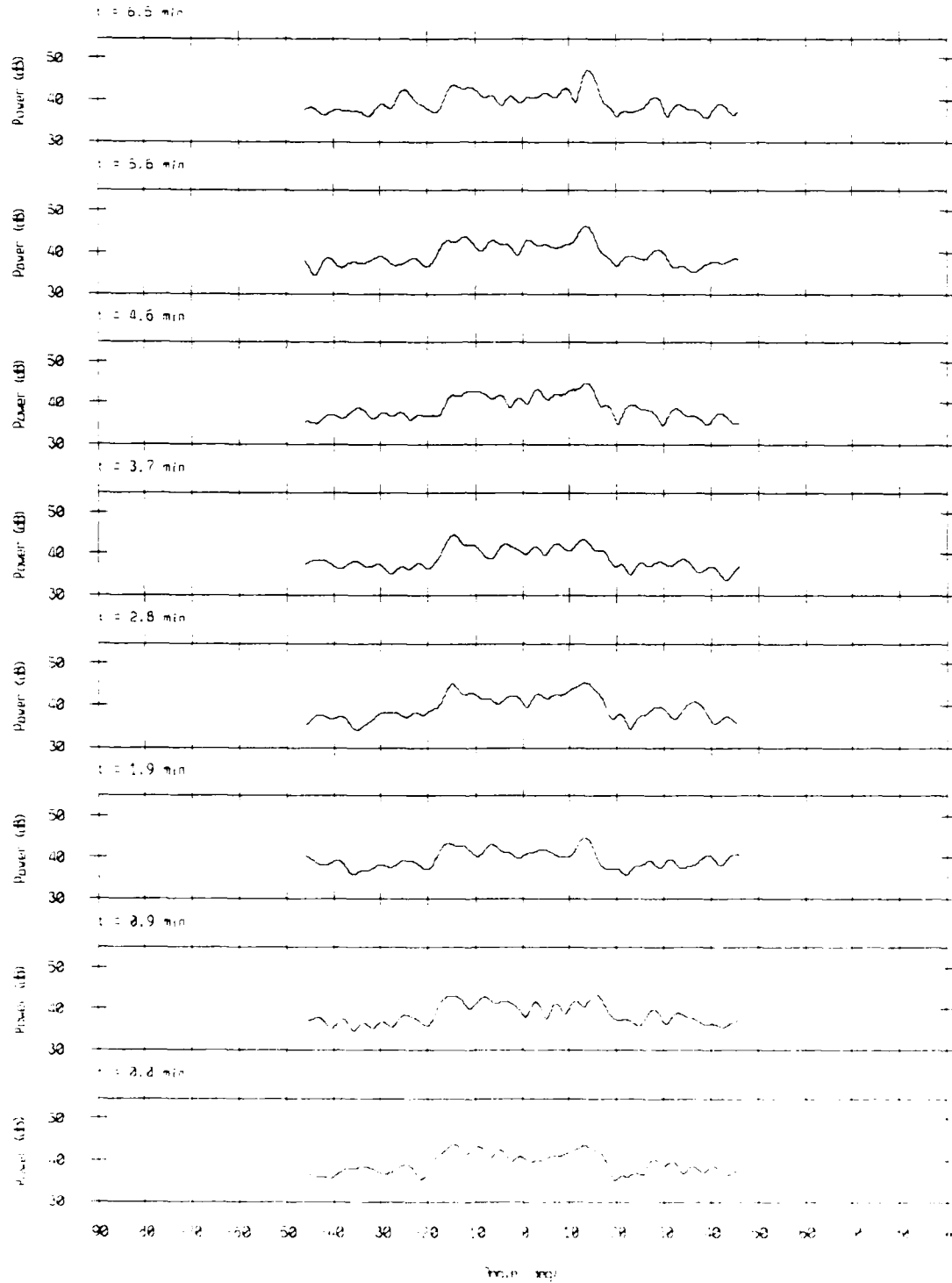
Array Response - 86180 Bin #6012

$f = 275$ Hz, rect window



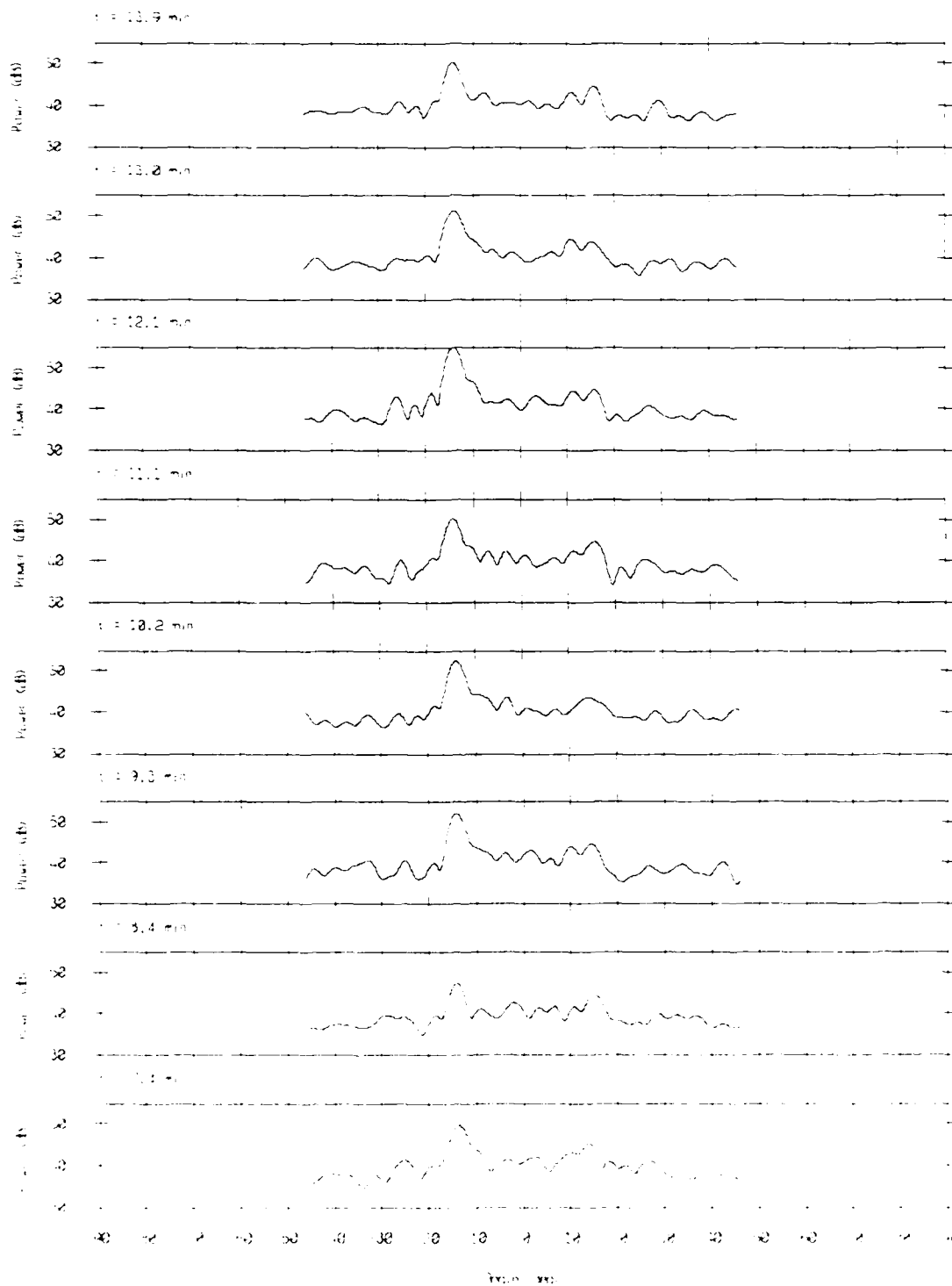
Array Response - 86180 Bin #6186

$f = 320$ Hz, rect window



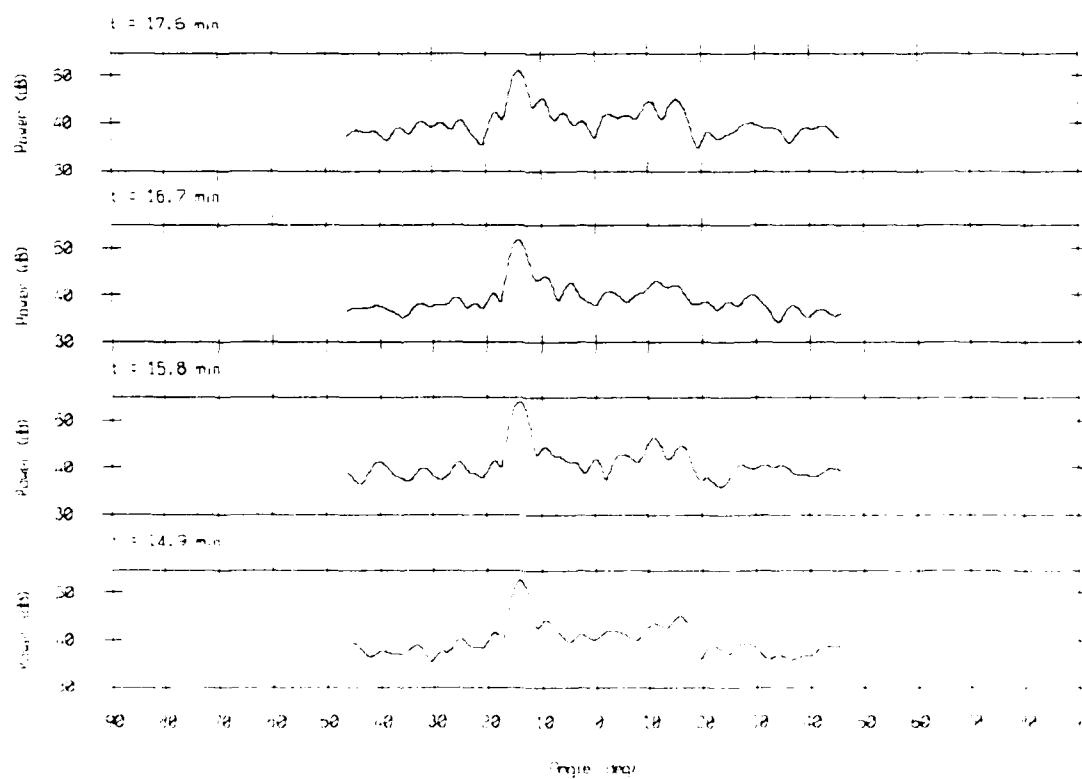
Arroyo Response - 86180 Bin #6186

$f = 300$ Hz, rect window



Array Response - 86180 Bin #6186

$f = 300$ Hz, rect window



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